

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information

of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XLII., No. 14.

FRIDAY, APRIL 5, 1907.

An interesting development of Hill-Harriman competition in the far Northwest, in which the Canadian Pacific is involved, has come about during the past week, if a despatch from Ottawa is correct. According to this report the Canadian Pacific has made an agreement with the Oregon Railroad & Navigation Company for trackage rights over the Harriman line from Spokane, Wash., to Portland, Oregon. This seems like an absurd report until it is remembered that the Spokane International, a new road from Yahk, B. C., on the Canadian Pacific's Crows Nest Pass branch, southwest to Spokane, was built under Canadian Pacific auspices and brings that company into Spokane, giving it, with the Minneapolis, St. Paul & Sault Ste. Marie, a chance to compete with the Great Northern and Northern Pacific for through business from Spokane to and from St. Paul and Minneapolis. The reported arrangement for running rights to Portland would open that important Pacific coast city also to Canadian Pacific competition on through business. If the Harriman lines have made such an arrangement with the Canadian road, it seems likely that the contract stipulates that it be used only on through business to and from points on the Canadian Pacific's lines east of Spokane, all of which, without exception, are out of the territory of the Harriman lines, but at many of which the Hill lines actively compete with the Canadian Pacific. It is not likely that, even for the sake of injuring its great rivals, the Harriman line would bring it about that the local business between Portland and Spokane should be divided among three instead of two competitors. The effect of such a traffic agreement on the Hill lines can, in the end, hardly be a serious one, for as soon as the Portland & Seattle—the new low grade line from Spokane down the Columbia river to Portland—is finished, Mr. Hill will be able to hold entire control over rates in that territory. No other road is going to be able to carry traffic as cheaply as this new line, with a maximum grade of 22 ft. to the mile eastbound between Portland and Spokane.

The Pennsylvania Railroad has this week created a new grand division, the Western Pennsylvania, comprising nearly all of the coke region, most of the coal region and all of the Pittsburgh mill district, tributary to the eastern lines. This was the western end of the Pennsylvania Railroad grand division, which is now divided into the Western Pennsylvania and Eastern Pennsylvania grand divisions. The announcement of the changes in officials caused by

this territorial reorganization includes 16 men advanced to higher positions. It is noteworthy that of this number nine are college or university graduates, the list including two graduates of Lehigh, two of Lafayette, one of the Massachusetts Institute of Technology, one of Georgetown University and Stevens Institute of Technology, one of the University of Pennsylvania, one of Princeton and one of Yale and Rensselaer Polytechnic Institute. The new General Superintendent, his successor as Superintendent of the Pittsburgh division, the Principal Assistant Engineer of the new Western Pennsylvania grand division, the new Superintendent of Motive Power of the Erie grand division (Philadelphia & Erie) and the Northern Central, the new Superintendent of the Middle and Western divisions and of the Alleghany division, the Principal Assistant Engineer of the new Eastern Pennsylvania grand division, the Superintendent of the Pennsylvania, New York & Long Island Railroad, and the new Principal Assistant Engineer of the Philadelphia, Baltimore & Washington are all college graduates. Two new Superintendents, an Assistant Superintendent, a Superintendent of Telegraph and the Superintendent of Motive Power of the new Western Pennsylvania grand division are not college men. This high proportion of college men in a list of promotions which happen to be announced together, shows the exceedingly important place which is being taken on the Pennsylvania by the man with a university training. It is noteworthy, however, that all of the new operating officers who worked up through positions in the operating department proper began without such advantages. The Pennsylvania has not applied its plans of training young college men for official positions to the operating department as such. The four new college-bred superintendents in this list began, without exception, in the engineering department. The Pennsylvania's success in developing college men into valuable officers has been too often favorably commented on in the *Railroad Gazette* to make repetition necessary. The road is probably better operated than any other railroad in the country and, at the same time, the proportion of college men in its service is larger than on any other line.

A representative of the Brotherhood of Locomotive Engineers has written a letter protesting against the law proposed in New York State empowering the railroad commission to establish standards of fitness for railroad employees. He thinks that the matter should be left to the railroads themselves; that the roads must

be as anxious as any one to have competent men. This engineer manifests the same spirit as his brothers who have so many times protested against every move made by railroad officers to do away with the dangers due to color blindness and myopia—a spirit due to a deplorably common form of mental and moral myopia. The agitation of the past year has awakened men's minds to the extent that we now see railroad officers sitting up and taking notice, in a way that they never did before. One of them (Mr. Shonts) announces in advance the purpose of his company to comply with the wishes of the people of the state of New York as expressed in the proposed new railroad law. But the employees, who are all the time asking for some law or other, begin to complain the moment that any law proposes to touch them. Governor Hughes has good reason, no doubt, for desiring to establish standards of fitness for enginemen independent of the railroads themselves, for railroad officers have publicly complained that the employees' brotherhoods force the maintenance of low standards. No one can tell whether the Governor will succeed in his purpose to establish in the state of New York a strong commission of high minded men, or whether such a commission—having to look after gas, electric lights, trolley picnics and "car-ahead" grievors—will be able usefully to regulate engine running and the management of block signals; but it is high time that somebody did something. The railroads are, indeed, anxious to have efficient enginemen, but anxiety is not the thing needed. The anxious railroad superintendent would greatly promote the safety of his trains and the prosperity of his company by forgetting his anxiety and practicing foresight and courage. Officers who, like the late Alfred Walter, fearlessly carry out rational rules for the efficient management of the road, in spite of cowards above or secret intriguers below, have no time for anxiety. When grievance committees coerce superintendents into retaining poor men on fast trains, a state standard of efficiency may be a useful thing, in spite of its defects and in spite of the mischievous possibilities of governmental participation in the details of management. When a man like Mr. Kruttschnitt, whose discipline is warmly praised by many observers, comes out and calls for public investigation of defects in train operation, it is fair to conclude that the alleged demoralizing influence of brotherhood committees is not an imaginary evil.

AN ACTIVE RAILROAD COMMISSION.

The State Railroad Commission of Indiana, composed of Messrs. Union B. Hunt, C. V. McAdams and William J. Wood, is one of the newest bodies of that kind, but it is also one of the most efficient, if we may judge by the strong report which it has made on three recent train accidents. Of this report, dealing with the collisions at Woodville and Fowler and the powder explosion at Sandford we give an abstract in this issue.

On the explosion the report is exhaustive, as, of course, it should be when the cause is left undiscovered. All possible clues seem to have been followed up but no cause can even be guessed. The report as published is defective in not giving names of witnesses or a summary of testimony; neither does it give authority for all of the positions taken on technical questions. It depends for its authority too much on the word of the commissioners themselves. Still, it is so terse and clear that that word will be readily accepted by the public.

On the collisions also the commissioners ask the public to take their word, and some of the things said show that they have not explored the subject of train management with sufficient thoroughness. They speak of the "excellence" of the block system without showing wherein its excellence consists. They accept the railroad officers' denial that violations of rules are winked at, but do not seem to have found out what the officers' eyes actually were doing when they are alleged to have been shut. The commissioners "spent much time" in trying to decide whether the Standard Code of Train Rules is or is not the infallible preventive of accidents which some seem to believe that it is, without discovering that they were being led on a useless path—without seeing that on every railroad the first and most pressing question in this matter is that of securing obedience to rules that are known to be perfect. Still, as we have said, the report is a strong one. The commission has reached sound conclusions and we must not find too much fault with its processes.

A chief excellence of the report lies in its close adherence to primary essentials. The problem of reforming American railroad train service is complex and difficult, and a lack of thoroughness or even actual mistakes may be forgiven an administrative

body if there is a determination to tackle the big end of the problem first. The present report goes right to the heart of the trouble. Employees must be familiar with the rules. The supervising officers should "acquaint themselves with the individual capacity of the men," and should hold examinations repeatedly until this is accomplished. The value of this last recommendation is questionable, for there may be much waste of energy in re-examining experienced men once a year—as is suggested by the record of Engineman George Lamb, referred to by the commission; but the examinations will not necessarily be harmful. The "convention" to be held by the commission annually to "jack up" the discipline of the roads is also unlikely to be of any tangible benefit; but it may do good by stirring waters which otherwise would be stagnant. There is great need everywhere of improved training of men, and almost any means to this end is to be commended.

The recommendation that the block system be installed is not only sound, but is clinched by the statement that the roads can afford it. Some roads enjoying good incomes are reminded that others in the state, with poorer incomes, have used it for years. The basis of earnings proposed—\$5,000 per mile per year—was raised by the Legislature to \$7,500. The lower limit was reasonable, we think; but both are loose standards. A far more equitable rule would be to take the business of each division of a road by itself, for a busy road with a large mileage of thin branches might escape the law when another busy line without branches would have to comply. This is only a temporary question, however. The block system is suitable on thin lines as well as on heavier ones, and in most cases can be made equally economical, for the block sections can be lengthened to correspond with the longer time intervals between trains.

The commissioners are also very clear on certain details, as, for example, the bad arrangement of switch and signal lights at Fowler, but in modesty their recommendation goes even farther than the polite, dignified and indirect suggestions of the British Board of Trade inspectors. Where signal lights are so situated that an engineman cannot see them when running at "service speed" in a fog, as is declared to be the case at Fowler, the only possible position for a state railroad commission to take is that high speeds should be forbidden. The commissioners are to be commended for making prominent Engineman Lamb's testimony. The brotherhood leader who claims that men have a hard time trying to obey rules is not wholly wrong, for many are so shortsighted as to really believe that they are bound to try to please short sighted trainmasters who by "suggestion"—to use a medico-psychological term—tempt runners to take risks. But brotherhood spokesmen, like some company spokesmen, often have no perspective. It is impossible to tell whether they represent 2 per cent. or 90 per cent. of their constituents, in their description of conditions.

Three recommendations of the commission have not taken form in legislation: (1) to forbid the employment of persons under 21 years in the telegraph service; (2) that the railroads should not grant the demand of the public for unreasonably high speed, and (3) that as there have been many derailments, and much over-capitalization of railroads, and earnings are now large, the railroads should appropriate more money to improve their roads and equipment. The first of these is justified, and the report succinctly states the reason for it. The other two are brief and inconclusive and are not supported either by facts or arguments; and it is not clear why they were allowed to mar an otherwise good report.

RAILROAD STOCKS IN THE MARKET.

To the average man with some money to invest, who believes in railroads and in the railroad business, but has neither time nor inclination to become intimately familiar with the ways of Wall Street, the problem of the desirability of railroad securities as investments at market prices is often one of considerable interest. If, above all other considerations, security of the amount invested is desired, the funds will be invested in bonds of the highest class. Laying aside from consideration this class of investment, yet without attempting to look at the subject at all from the standpoint of the average stock market speculator, it is interesting to consider, even if in a very elementary way, the opportunities which railroad stocks offer for profitable investment. This is because stocks are as a rule more attractive to the average business man who can afford the risk of loss of part of his principal as the price of the opportunity to share in the growth and prosperity of the country as reflected in the increasing price of railroad shares. By this we do not refer to buying on margin or anything else than outright purchase of

such securities; but even entirely from an investment standpoint, the speculative element must always be considered. In the first place one of the chief advantages of railroad stocks is that they can always be sold on short notice, in other words, that there is always a market for them; and as the necessity of selling is always a possibility, the price at which they can be sold, in comparison with the price at which they were bought, is always potentially of large importance in such investments. But even assuming that stocks are held permanently as steady investments, the price paid is of supreme importance, since it determines the rate of return which is received on the original investment.

It is clear that the stock market does frequently present opportunities for profitable investment in railroad stocks, and in a certain degree, the man who is too busy and, we believe, too wise to follow the stock market day by day has an advantage over the practiced speculator. This is because Wall Street reacts on itself, so that the man who is in close touch with it sometimes loses his sense of proportion in regard to those things with which he is most familiar. More than this, the man who buys outright for investment always has an advantage over the speculator whose purchases are made with borrowed money, and are, therefore, dependent to a large degree on the money market. Periodically, usually through a combination of these two factors, a wave of pessimism, reflected by large declines in the market prices of railroad securities, sweeps over the Wall Street market and for some reason, apparently good, is accepted by the larger part of the financial community. Once started, such a trend of thought sometimes becomes for the time being an article of settled faith. The very facts which a few weeks before were urged as most important arguments for higher prices are turned about and held to be reasons for still further declines. The country may be prosperous and business at a high level, but for the time being nothing appeals to Wall Street but the dark side of the picture. As a result the prices of railroad stocks go to levels at which they prove later to have been most attractive purchases. Yet so insistent is the Street on disaster that, although at the time prices are low it is pointed out that stocks are selling far below their probable investment value, securities are sold in large amounts in expectation of still lower prices. Finally the tide is turned, often by some one striking event and sometimes with great rapidity the market advances to a higher level of prices.

At times like these—and, of course, we realize perfectly the difficulty of telling at the time when precisely such a condition exists—come the opportunities for men whose chief interests are outside the stock market, but who have strong faith in the ultimate prosperity of the country and the country's railroads, to buy railroad stocks at a price which usually turns out to be highly profitable. It is, of course, too much to expect of human intelligence or good luck that a man will be able to buy at the bottom or sell at the top. The point to be made is that there come opportunities when professionals are disorganized and pessimism rules the market when a man with faith in the future and a reasonable knowledge of the railroad situation has an opportunity to invest his money with strong likelihood of an increase in value of his investment. It must always be remembered in this connection that it is the man who buys his stock outright who, short of a reduction of dividends, need not be worried from day to day over the course of the market. It matters little to him whether his stock for the time being is selling 10 points higher or lower than his purchase price so long as the regular dividends are being paid, for in general when he owns stock outright he can wait until a favorable time to sell.

The stock market has recently been reflecting an unusually severe wave of pessimism. Three weeks ago came a drop in the market quotations of railroad stocks more precipitate than the declines during most of the memorable panics in the history of the stock exchange and, since it followed a long downward movement of prices, more cumulative in its effects. This was followed by recoveries, but on Monday of last week another decline brought prices in most cases below the low records made on March 14th. The severity of the drop in prices can be realized from the fact that most stocks sold at lower prices than at any time since 1903, and in many cases lower than for six or seven years. This is even more true if changes in dividend rates be disregarded by making the comparison from the standpoint of the investor exclusively, that is, on the basis of income yield. In other words, in spite of the remarkable and unprecedented prosperity of the whole country during the past two years, in spite of the tremendous earnings of the railroads, and in spite of spendings out of earnings for extraordinary additions and betterments to railroad lines and equipment far larger than ever before known, it has within the fortnight cost less to obtain a partnership interest in the ownership of the

country's most successful railroads than at any time for from three to seven years; the longer period, it will be observed, going back to the days when many great railroad properties had only lately emerged from reorganization or bankruptcy.

There are a number of causes which have contributed to this remarkable state of affairs. Natural reaction from an abnormally high period, stimulated by extreme tightness of the money market due to unparalleled demand for new capital in all productive enterprises, doubtless heads the list. But many other contributory causes, playing into the hands of the professional manipulators, must be added. Chief of them is "high finance," or rather the disclosures of it, which have resulted in destroying popular faith in some of our most prominent railroad financiers, and, as a necessary consequence, in railroad securities. The misuse of trust funds laid bare by the insurance investigation a year or more ago, the manner and matter of the Southern and Union Pacific dividend declarations last August, the retiring of Stuyvesant Fish as President of the Illinois Central, and, in a way, the Great Northern's ore land distribution (though this is a remarkable example of the way in which Mr. Hill shares property, much of which he might have held for himself, with his stockholders), and last, and probably most important of all, facts brought out in the Harriman investigation—examples all of the utter ignorance and helplessness of the small stockholder, as compared with interests in control of a property who may or may not act as real trustees—have overthrown the confidence of the average investor. He has come to feel, and there are, unfortunately, only too many happenings which justify the opinion, that the stock market is a crooked gambling game, with prices shot up or slid down at will by a few men who owe their power to the fact that they are trustees for other people's property. It is this sense of helplessness as against powerful manipulators, this belief in the unfairness of those who at the same time control and profit by price factors, that has for the moment turned the stomach of the public against railroad investments.

Distrust of the prices quoted by Wall street for its wares has lately been proved to be well justified. Last November there were repeated predictions that an era of larger railroad dividends was at hand. A new high level of prosperity had been reached, which was already, and in the future would be still more, reflected in largely increased dividends. The event which especially called forth this view was the declaration in August of a dividend at the rate of 5 per cent. on Southern Pacific common, which had previously received no return, and 10 per cent. on Union Pacific, which had been receiving 6 per cent. Not long afterward the Atchison dividend was increased from 4 to 5 per cent. and the Pennsylvania rate of distribution from 6 to 7 per cent. There were also increases in the dividend rates on the stock of four of the Vanderbilt roads—the Lake Shore payment from 8 to 12 per cent., the Michigan Central from 4 to 6 per cent., the Pittsburgh & Lake Erie from 10 to 12 per cent., and the New York Central from 5 to 6 per cent. The fiscal year ended June 30, 1905, was, when it closed, the most prosperous which the country had ever seen. When to the high records then made were added the tremendous increases in earnings shown by nearly all companies during the 1906 fiscal year, with crops of all kinds the largest in the country's history, the iron business at the top notch of prosperity and orders for new railroad equipment at higher figures than ever before known, there was held to be every reason for even higher prices for railroad stocks. There was high record piled on high record, with the result that the country stood at a point unknown before in evidences of prosperity. It had advanced so far that it was argued that in spite of the fact that most railroad stocks were selling at or near the highest prices ever recorded, they were cheap in view of their immense possibilities in the future.

The course of prices during the last three months has shown how false was this view, at least so far as market values were concerned. With utter disregard of the country's teeming prosperity, the prices of railroad stocks, particularly those of which most in the way of higher prices was expected, fell swiftly to the lowest levels for years. No receiverships were announced, no payments were passed, no dividends reduced. On the contrary, on the very day of the most panic declines, a weak road, not unfamiliar with receiverships—the Toledo, St. Louis & Western—announced its first dividend. This week the Kansas City Southern followed suit, and the Atchison, before ever completing a year's payment at the new 5 per cent. rate, established 6 per cent. as its annual rate of payment.

It is true that there are a number of unfavorable things about the immediate future of railroad properties. The hostility of public

opinion against the railroads as transportation companies, due to unjust practices in their operation similar to those already mentioned in financial management, has been shown in the great number of legislative measures proposed and passed against railroads during the present sessions of the state legislatures. This railroad legislation, added to the distrust by the public of high finance methods, makes it for the moment impossible for the railroads to get, at anything like usual rates, money with which to carry out the tremendous improvements which are necessary in order to efficiently handle the immense traffic which is being offered. Either funds are being secured on short term notes at extravagantly high rates of interest or, more generally, improvements are being postponed. Besides this, most of the new laws passed by the state legislatures will, for a time at least, threaten net income, which is already being reduced by higher cost of all kinds of labor and materials with no corresponding increase in receipts. It is even probable that not far ahead is a period of some let-up in business activity.

Yet from the present investigation of railroad problems there is sure to result a better understanding between people and railroads. No laws which permanently take away value from railroads will, even if passed, be likely to stand. Even a let-up in business undertakings would have its advantages as a pause in the most prosperous period in the country's history. At present prices, railroad stocks discount most unfavorable developments which might come. It is, of course, possible that prices may soon go as low again or lower than they did last month; nevertheless, when it is possible to buy stocks like Illinois Central; New York Central; Chicago, Milwaukee & St. Paul; Pennsylvania; Baltimore & Ohio and Union Pacific at prices returning from 5 to 7 per cent. on the investment, is it not reasonable to suppose that this represents an opportunity of the sort we have described, to place money at a favorable rate of return with the further good possibility of increase in value of capital over a period of a few years? From the standpoint of the investor whom we are considering, as a general principle, the time to buy is when there has been a long decline in prices and pessimism is rampant. Present opportunities for investment can hardly fail to appeal to the man who forms his own opinions and looks forward beyond the immediate future.

The Interstate Commerce Commission, having the power to be more absolute, appears to be becoming more conciliatory; or, at least, its conciliatory efforts seem to be more successful. With a law framed in the unruly spirit of 1906, the Commission's acts reflect the spirit of 1870, when Charles Francis Adams laid down the principle that persuasion was better than force. Can it be that the law is used by the Commission as a "big stick"? Last week the railroads in the Indiana-Illinois bituminous coal field announced a 10 to 15 per cent. advance in rates to Chicago on coal, but a protest to the Commission resulted in a prompt change of mind on the part of the roads, following "suggestions" from the Commission. This week another "suggestion" from the Commission has resulted in postponing an increase of rates on grain from April 1 to May 1. While this is only a postponement, some think that by May 1 the roads may decide not to make the advance. The Commission's announcement says: "Carriers in Western Trunk Line, Central Freight Association and Eastern Trunk Line territories having filed with the Commission tariffs increasing their rates on eastbound grain and grain products, to become effective on or about April 1, and it appearing to the Commission that the conditions and circumstances warranted a suggestion to these carriers that the date upon which the increased rates would become effective should be temporarily postponed, and such suggestion having been made by the Commission and cheerfully and cordially met and accepted by the carriers, the Commission has issued an order granting such carriers permission to at once post and file, effective April 1, 1907, amendments postponing the date of the taking effect of the proposed advances in rates on grain and grain products to May 1, leaving the present rates in effect until that date, and on that date canceling the present rates and making the advanced rates effective." With everything so harmonious, it will perhaps be unkind to suggest that this revocation of tariffs which have been posted for two or three weeks may work injustice to somebody, for "what is the constitution between friends?"—but it is probably true, now as in the past, that every technicality that can be seized by a lawyer as a basis for a test case, will be thus seized, sooner or later, if the opportunity continues.

The Pennsylvania Railroad announces that in the last three months 97 surprise signal tests have been made on the road, and that in that time 2,252 trains have been tested and 97 per cent. of the enginemen have complied with the rules of the company, while the 3 per cent., who are deficient, brought their trains to a stop, but not

until after passing the signals. In the three months many men have been suspended for from 2 to 42 days each for infraction of rules, it is said. Of the 180 trains tested on the main line recently 98 per cent. obeyed the rules absolutely. Tests made on the New York division, where trains are operated so frequently and many on high-speed schedules, give a perfect record. These tests are made on all divisions, and the records show a constant decrease in the percentage of those not obeying implicitly all rules. Surprise tests have been found to be the best method of keeping the enginemen always on the lookout for anything unusual. The cheering feature of this official statement is that there is a constantly decreasing percentage of disobedience. Three failures in a hundred is a high percentage, and, if there were not a promise of improvement, would be discouraging. This is not a "slap" at the Pennsylvania, for its neighbors would do no better, probably; many roads' records would be worse. All railroad theory demands that every division shall show as good discipline as the best division—which, in the case of this Pennsylvania report, would be 100 per cent. Why are we so slow in bringing our practice up to the theory? Some superintendents will say that editors are mere doctrinaires; these three runners out of a hundred did not do anything dangerous; they only ran past a signal a few rods, probably. But the hard fact is that doctrine is at the basis of practice. Those who sneer at the doctrinaire almost invariably follow theory themselves as long as their courage holds out. Davy Crockett (in the play) reminds us that a huntsman must not only be able to hit the game, but—if he is a Crockett and worthy of the name—must put the bullet in the rabbit's eye. Huntsmen with a lower than the Crockett standard will never accomplish the best that is in them. Enginemen who wish to be worthy of the high encomiums which they so often receive should see that the nose of the pilot never goes beyond the stop signal. That ideal will carry them to the top of the list much faster than will a reputation for saving a few seconds now and then, by running the risk of using, without leave, a few hundred feet of the clear track that can be seen beyond the signal.

CONTRIBUTIONS

The Columbia Bridge.

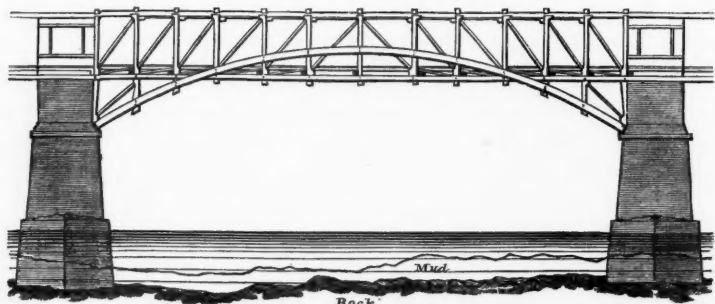
Philadelphia, March 20, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In his article entitled "The First Railroad Owned and Operated by a Government," in the *Railroad Gazette*, August 24, 1906, Mr. C. H. Caruthers says:

"An inclined plane was used for a time at Columbia, and another at Philadelphia, opposite Peters Island, about where the Columbia bridge now stands."

Of course Mr. Caruthers does not mean to state that the inclined plane stood "where the Columbia bridge now stands," i.e.,



The Viaduct Near Peters' Island.*

spanning the Schuylkill river, but it may be worth while to mention that the inclined plane (which was then far to the northwest, beyond the city limits) extended from the western end of the old Peters Island bridge up to the power house, which must have stood not far from the present Belmont mansion, the Colonial residence of Judge Peters, where Washington frequently visited.

Most of the way the plane was in shallow excavation, by means of which the line is still distinctly traceable. The upper half of it is now occupied by a portion of the line of the Fairmount Park trolley system. In a letter to the *Philadelphia Public Ledger*, under date of September 16, 1886, Mr. W. Hasell Wilson says: "The Schuylkill bridge was designed by Major John Wilson, Chief Engineer, and the construction was superintended by W. Hasell Wilson, Principal Assistant Engineer, and Frederick Erdman, Bridge Inspector. Mr. John C. Trautwine was Assistant Engineer in charge of graduation and track laying."

Mr. Caruthers says: "From Hollidaysburg west a portion of the road at least was laid on stone blocks instead of wooden ties, and within a very few years a number of these blocks still re-

*From a copy of the *Journal of the Franklin Institute* for August, 1834, kindly furnished us by Mr. Trautwine.

mained in place and were occasionally sketched by artists in their summer rambles through the picturesque scenery of the neighborhood." These stone blocks were used also on portions of the line in the vicinity of Philadelphia. As late as 1876, they were still to be seen, bearing the rust marks of the rails, on the line of the Belmont inclined plane; and, within the last half dozen years, I saw a fine stretch of them on a straight piece of line, about a hundred yards long, crossing a level bit of ground near the present Narberth station of the Pennsylvania Railroad. This was on the portion of the line connecting the head of the Belmont plane with the present line at Ardmore. Numerous short pieces of this line may still be traced.

JOHN C. TRAUTWINE, JR.

Spike Pressures on Curves.

Iowa City, Ia., March 30, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The interesting attempt to determine the rail pressures against the outer spikes of a railroad curve seems to omit one item that must certainly have some influence on the result, and also to neglect certain facts that seem to disprove the conclusion though not the method of attack.

Omitting the fact that the action of the wheels on the curve is totally unknown and theoretically unknowable, the possible experiment may increase knowledge of this intricate matter, and assuming that the method of solution given in the *Railroad Gazette* of March 15 and 22 is correct so far as it goes, does it not fail to consider that before the spike may have its full pressure the rail must bend? Is it fair to say that a given short section of the rail is a solid, inelastic block, free from the rest of the rail, transmitting to the spike whatever lateral pressure there may be less the friction on the tie plate? Are the tie, spikes, plate and rail so rigidly joined that the full lateral pressure can come on the spike without the slightest give of the rail? And if they are, and the results of the computations made for the Harlem curve are correct, how is it that hundreds of spikes without tie plates, strained every day by pressures equal to and exceeding those found for the Harlem curve, are not driven daily out of place by the crushing of the wood behind them? Far less pressure than the shearing strength of the spike, when there is no tie plate, will push the rail over so far as to clear the head of the inside spike (see *The Transit* for 1905), and there would be several trains off the track daily, the country over, if the pressures indicated by the Harlem curve discussion actually occur.

It is not meant to assert that the discussion is incorrect for the pressure coming on the rail—it is probably as nearly correct as our knowledge of the conditions will permit—but to suggest that this pressure never reaches the spike, and that this is proven by the fact that trains all over the country are run at excessive speeds and stay on the track when the theory of the Harlem discussion would indicate that they should leave the track owing to the crushing of the wood behind the spike.

With a shouldered tie plate, moreover, it is unquestionable but that whatever pressure does finally reach the spikes is divided among all the spikes of the plate, whether two or three. This consideration indicates the value of the shouldered plate, and the discussion also seems to indicate the value of the plate with cross lugs as compared with those having longitudinal ribs, as was pointed out in *The Transit* of 1905.

WM. G. RAYMOND.

The Profitable Weight and Speed of Freight Trains.

Pittsburg, Pa., April 1, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Noting Mr. Wild's criticism of February 20 (published in your issue of March 29) of my communication of February 8, wherein Mr. Wild suggests that, on the basis of my figures, a reduction of 30 per cent. in the trainload would make practicable an increase in speed of from 10 to 20 miles per hour; and Mr. Wild is willing to accept this situation and reasons that this would still show a profit of some \$5,000 for the lighter load.

If Mr. Wild will kindly refer to table showing the operating statistics on the low-class and high-class traffic lines, he will find that a reduction of 30 per cent. in the average trainload would reduce the trainload on the low-class traffic line from 610 tons to 427 tons. This 30 per cent. reduction in the average trainload would have the effect of increasing the freight train mileage 43 per cent., also reducing the net earnings from \$2,993,111 to \$1,196,855. Necessarily, this reduction in net earnings would be transferred to operating expenses, increasing operating expenses from \$4,793,979 to \$6,590,235, thereby raising the operating ratio from 61.56 per cent. to 84.6 per cent., which Mr. Wild will probably agree would hardly be a satisfactory operating showing, and this simply goes to prove that the class of tonnage handled by a railroad is an important factor in determining the speed at which the railroad can afford to transport the tonnage.

Mr. Wild says:

"It is noted that Mr. Henderson's scale of reduction for increased speed does not agree with Mr. Worthington's. As to this the layman can only exclaim: 'Who shall decide when doctors disagree?'"

Let us see what the difference was between Mr. Henderson's figures for train resistance and those made by me, to ascertain just what logic there is to such a criticism:

Level resistance, lbs. per ton.	Speed in miles per hr.					
	10.	15.	20.	25.	30.	35.
Mr. Henderson's scale.....	5.0	6.0	7	9	10	11
Mr. Worthington's scale.....	4.8	5.8	7	9	11	13

As will be seen, the difference is slightly greater at speeds of 30 and 35 miles per hour, which were not involved in this calculation, and all railroad men who have given the train resistance question any study know that there are several formulæ for train resistance, all made from seemingly reliable data, yet a difference in weather conditions and rolling frictional resistance at the time the tests are made will usually make a difference in the results obtained in dynamometer car tests, but the difference between Mr. Henderson and myself respecting this matter is so slight as to be inappreciable, and this difference would not be apparent in the calculation which Mr. Wild attempts to make. I wish further to add that I have checked over the table prepared by Mr. Henderson in his article, and I find that it is not based upon pure theory, but apparently is deduced from average results in actual railroad practice.

Mr. Wild further says:

"There appears to be something radically wrong with the comparison that Mr. Worthington makes of a low-class with a high-class traffic line, inasmuch as he shows the high-class line actually with a lower revenue per ton mile than the low-class line. No wonder the ratio of expenses to earnings of the high-class line is much higher, considering that it undertakes to do a high-class business at a very low-class rate."

This comment, coming from a railroad statistician, rather surprises me, as my communication of February 8 draws attention to this and explains that the reason why the earnings per ton mile on the high-class line were $3\frac{1}{2}$ per cent. lower than on the low-class line was because the average distance hauled was 250 miles on the high-class traffic line, as against about 124 miles on the low-class traffic line. I also called attention to the fact, however, that the high-class traffic line received over \$1.28 for each ton carried, while the low-class traffic line received slightly less than 66 cents for each ton carried. These figures also appear in the operating table comparing the low with the high-class traffic line, and it seems strange that Mr. Wild should get the impression that the high-class traffic line was carrying its business at a very low-class rate, as the figures plainly show the reverse to be the case.

Mr. Wild further asks:

"Am I wrong in saying that an increase of 50 per cent. in the inclusive speed with which cars are handled for a decrease of 30 per cent. in the number of cars handled would have the permanent result of placing 20 per cent. or one-fifth more cars at the disposal of shippers over what are now available at Mr. Worthington's speed of nine miles an hour or thereabouts?"

If there was nothing to interfere with getting the full benefit of the additional five miles per hour in average speed, this reasoning would be good, but the trouble is that the difference between the nine miles and the fifteen miles per hour is spent at meeting and passing points, because of congestion incident to moving a large number of trains. Therefore, the reduction in the trainload of 30 per cent. to gain this additional speed would mean an increase of 43 per cent. in the train miles, thereby naturally increasing the number of meeting and passing points, which under present traffic conditions consume 40 per cent. of the total time between terminals, and the effect of the increase of 43 per cent. in the train miles to handle a given volume of tonnage would be to increase the ratio of delayed time to total time to such an extent as to nullify the benefit which would be derived from handling the trains at higher speed while actually in motion, and the operating results obtained from an experiment of this kind would simply be disastrous to the management that would undertake to handle its business in such an extravagant manner.

Please understand that I am not taking the position that engines on some railroads are not overloaded, because I have known many such cases, but where the tonnage rating system on a railroad is based on time and load—which is the basis used on the roads with which I have been identified—and where engines in dead freight train service are rated at 80 per cent. of the calculated engine ratings, enabling an average speed of fifteen miles per hour actual running time, which is the case on the low-class traffic line, my contention is that a uniform reduction of trainloads on the railroads generally would be wrong, because in the two cases which I cited of the low-class and the high-class traffic lines, the operating conditions and the average revenue received per ton on both these lines control the speed at which it is profitable for the railroad to handle its business, and the only way in which it can be determined whether the locomotives on any particular railroad are being overloaded to such an extent as to interfere with expeditious movement, or a movement

that can be said to be economical, is to take up and analyze all the conditions affecting the operations of the particular railroad selected.

I am still of the opinion, since the annual reports of the railroads of this country show at the present time an average daily mileage from their car equipment varying from 12 miles per car per day on single track roads moving low-class traffic to as high as 38 miles per car on roads with second, third and fourth tracks and handling high-class traffic, that this means that the equipment of the railroads of the country is moving less than 20 per cent. of the time, and while there is no doubt much good work can be done in carefully checking up and correcting delays in transit, yet it would seem that far more good could be accomplished by also checking and following up the delay which the equipment is suffering during the other 80 per cent. of the time. It is not my purpose to charge this entire 80 per cent. idle time up to the shippers, because much of the delay embraced within the 80 per cent. may properly be charged to delay at terminal yards and delay on the part of railroads in spotting cars on spur tracks at industries, and delay in gathering up the loads from industry tracks. It is probably not unfair to assume, however, that some considerable delay is occasioned by the shipper in unloading the cars and reloading them again for outbound movement.

B. A. WORTHINGTON.

American Railroads Not Overcapitalized.

New York, March 28, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The railroads of the United States are being attacked by adverse legislation, either planned or passed in every one of the 46 states of the Union. Some of this legislation will be confiscatory in its results. Much of it is unnecessary, ill-advised and harmful and some of it is proper and will be of use. All of it, however, has had the effect of undermining the credit of the railroads to such an extent that, for lack of money, necessary railroad work is being stopped or slowed up all over the country and the railroads who are doing any large amount of work have been forced to raise the money for it by short time notes at extremely high interest rates.

The railroads, almost without exception, should make large expenditures for additional cars, engines, terminals, second, third and fourth tracks, sidings and signals to properly and above all safely handle the existing enormous business and to prevent the curtailment of the general business of the country, due to the failure of the railroads to properly care for and handle it.

This necessary work of improvement or railroad betterment can only be carried on by such action on the part of the federal government or the various states as will restore confidence in railroad securities. The people of the United States are under great obligations to their railroads. The energy, push, ability and foresight of the American railroads has done more to develop the country than any and all other means, and this same energy has pushed the building of the railroads of the United States up to a point where there is one mile of railroad for each 381 people.

Year.	Population, U. S. census.	Miles of railroad.	Population to each mile of railroad.
1820.....	9,633,822	0	9,633,822
1830.....	12,866,020	23	559,392
1840.....	17,069,453	2,818	6,057
1850.....	23,191,876	9,021	2,571
1860.....	31,443,321	30,626	1,026
1870.....	38,558,371	52,922	728
1880.....	50,155,783	93,262	537
1890.....	62,622,250	166,703	375
1900.....	76,303,387	194,262	392
1905.....	83,143,000	218,101	381

Thoroughly to appreciate what this enormous growth of railroad mileage means, it should be compared with the railroad mileage in some of the principal countries of the world.

Country.	Miles of railroad.	People to each mile of railroad.	Sq. miles to one mile of railroad.
France.....	24,500	1,590	8.46
Brazil.....	12,370	1,158	260.16
Austria-Hungary.....	26,901	1,789	9.70
Belgium.....	4,337	1,631	2.62
China.....	3,500	119,714	1,143.00
German Empire.....	33,423	1,813	6.25
Italy.....	9,943	3,266	11.12
Japan.....	4,496	9,844	36.17
Russian Empire.....	38,045	3,548	220.24
Spain.....	8,206	2,267	23.90
United Kingdom.....	22,847	1,821	5.29
United States.....	218,101	381	13.61

These figures show clearly and positively that in the United States railroad building has pushed forward to a point where there is almost five times as much railroad mileage per capita or to where there is only one-fifth the number of people to support each mile of railroad, that there is in any of the great countries of the world. Surely had this not been the case, the country could not have grown to its great place among the nations of the world. With such a showing, is it right, fair or wise that the American railroads be punished, criticized and condemned because they have not had the time or money to double, triple, four-track and block signal their lines and to separate the grades of the highways and streets from those of the railroads? The present course of the people and their representatives in destroying the credit or the

money raising ability of the railroads and thus preventing or postponing for years this necessary work is most unwise.

As the English railroads, those of England, Scotland, Ireland and Wales, called the United Kingdom, are constantly cited to aid in criticizing and condemning the railroads of this country, the following comparisons are most interesting:

	United States.	United Kingdom.
Population.....	83,143,000	41,605,177
Area, square miles.....	2,970,038	120,979
Population per square mile.....	27	343
Miles of railroad.....	218,101	22,847
Area, square miles to each mile of railroad.....	13.61	5.29
Population to each mile of railroad.....	381	1,821
Per cent. of railroad single tracked.....	92.2 pr ct.	44.4 pr ct.
" " " double tracked.....	7.8 "	55.5 "
" " " treble tracked.....	0.74 "	5.2 "
" " " quadruple trkd.....	0.55 "	4.25 "
" side track to miles of road.....	32.1 "	60.2 "
No. railroad employees.....	1,382,196	581,664
Per mile of railroad.....	6.37	24.5
Per cent. of railroad employees to total population.....	1.66 pr ct.	1.39 pr ct.
Total stock capital.....	\$6,554,557,051	\$3,983,025,312
" stock capital per mile railroad.....	\$31,301	\$174,334
" bonds or other obligations.....	\$7,250,701,070	\$2,264,215,241
" bonds or other obligations per mile of railroad.....	\$34,625	\$99,103
" stock, bonds & other obligations.....	\$13,805,258,121	\$6,247,240,553
" Per mile of railroad.....	\$65,926	\$273,437
" gross earnings pr mile, yearly.....	\$10,611	\$24,199
" gross earnings, yearly.....	\$1,314,380,959	\$552,896,063
" passenger earnings, yearly.....	\$472,694,732	\$196,051,249
" freight earnings, yearly.....	\$1,450,772,832	\$274,724,438
" No. passengers carried, yearly.....	738,834,667	1,332,246,780
" tons freight handled, yearly.....	784,920,188	461,139,023
Average number of train-miles per mile of railroad.....	4,761	17,548
Total miles made by passenger and freight trains, yearly.....	1,038,441,430	400,923,198
Total No. employees killed, 1905.....	3,361	393
" " pass'gers " 1905.....	537	109
" " other prsns " 1905.....	5,805	551
" " all persons " 1905.....	9,703	1,053

These figures show that 92.2 per cent. of the railroads of the United States is single track, while only 44.4 per cent. of the railroads of the United Kingdom is single track. Also that relatively the railroads of the United Kingdom have seven times as much second, third and fourth tracks and nearly double as much side track as the railroads of the United Kingdom. Without question, these additional facilities add largely to the safety of operation. However, they cost money and without credit are hard to get. The railroads of the United Kingdom have about four times as many employees per mile and 1.7 times as many per \$1,000 gross earnings as the American railroads. The pay of their employees, however is greatly less.

One of the chief criticisms of the railroads of this country is that their finances are not handled in the conservative manner of the railroads of the United Kingdom, and it is claimed that our railroads have over-issued their securities and that their capital is largely water.

The above comparisons show that the railroads of the United Kingdom have issued about five times as much stock and three times as many bonds per mile as the railroads of this country, and that the total average capital issued against each mile of the railroads of the United States is \$65,926, while the total average capital issued against each mile of the railroads of the United Kingdom is \$273,437, or nearly 4.15 times as much.

There is no question that in this country there have been a number of cases of overcapitalization. The railroads as a whole, however, are not overcapitalized and could not be duplicated to-day at anything like their present capitalization; the conservatively managed railroads of the United Kingdom having issued over four times as much capital per mile as the railroads of this country. If the operation of the railroads of the United States is not as safe as those of the United Kingdom, and this unfortunately is clearly shown in the above comparison showing the large loss of life on the American railroads, and if the service of the American railroads is not satisfactory, the movement slow and the car supply inadequate, how much better it would be for the people of the United States were their political representatives to join with the railroads of the country in restoring confidence and credit to the railroad securities so that all necessary betterments in tracks, facilities, equipment, signals and other needed improvements may be promptly made with money obtained at a fair rate of interest, and if these conditions are followed out there is no question but that then the American railroad will do for the future what it has done for the past, that is, aid to a greater extent the building up and growth of these United States than any and all other causes.

As the increase in railroad capital necessary to meet the wants of the country will be enormous, as is indicated by the statements of railroad presidents and as implied by a comparison of capital with that of the English railroads, great care should be taken on the part of the government to exercise such control over increases in capital as will prevent the possibility of fraud.

If the government so limits and surrounds the issuance of additional railroad capital with conditions hard or difficult to meet, and conditions as to cost or rate of interest, only the more prosperous of the railroads will be able to obtain capital, and only they

will be able to continue the proper development of their properties. The railroads most needing additional facilities and improvements will be debarred from obtaining capital and will remain largely in their present crude and unfinished conditions.

The question of the control of railroad capital is one of such vast and far-reaching importance that it should only be handled with the greatest care after the most thorough study and consideration.

The good sense of the people of the United States can always be trusted and with just a little more light on the railroad question they, the people, will straighten it out by the purchase for investment of all the very good things on the market in the railroad security line and with the great public more generally interested in railroad investment, legislation largely for the political advancement of its proposers will become quite unpopular, and only such laws as will advance the public and railroad interests will be passed.

The railroads of the United States have little to fear from adverse legislation and are to-day, as they have been in the past, one of the most desirable and safe forms of investment.

C. S. SIMS,
Assistant to the President, Erie Railroad.

An Imaginary Lobby.

Washington, D. C., March 27, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Half-truths; exaggerations; jumbled chronology, to make things totally unrelated seem related; rarely, whole prevarications; these constitute the gentle art of the muck-raker. Thus, keeping just within the line which separates innuendo from tort, he has turned slander into a trade and his publishers have discovered that that which barely evades the law of libel may be commercially profitable. An article entitled "The Railroad Lobby" in the current number of a magazine, which I will not advertise, seems well to illustrate this method. It starts with the untruth that "the greatest single special interest in the nation is the railroad interest," a misrepresentation of which even a muck-raker would not be guilty if he paused to consider how easily accessible are the data which prove that the farms of the United States are worth twice as much as their railroads and that the annual revenue of the former industry is at least three times that of the latter. From this appropriately ignorant beginning the article proceeds to a description of an alleged railroad lobby, said to be located in Washington, which, as a mere feat of the imagination, deserves a high place in the ranks of American fiction. The series of misrepresentations is too long to permit the separate correction of each of them, but a few typical examples may be examined. Thus it is asserted that a "branch" of the alleged railroad lobby was quartered, while the Hepburn rate bill was being perfected, in Vice-President Fairbanks' room in the Capitol, but the room described was never the room of the Vice-President, his room being in a widely different location, and it was not, during any part of the time alluded to, under the control of Mr. Fairbanks. Neither the room described nor any other room at the Capitol was ever used for any such purpose as that alleged. The facts were that the immense labor of compiling and digesting the testimony gathered during the investigations of the Senate Committee on Interstate Commerce required the temporary employment of a force so much greater than that ordinarily maintained that additional room was absolutely necessary. Under these circumstances the Secretary of the Senate, temporarily assigned to the Committee, for the use of its regular and temporary employees, the adjoining rooms on both sides of that which it ordinarily occupies. These rooms were never used by anyone not in the employ of the Committee or for any purpose except the prosecution of the work assigned to the Committee by a resolution of the Senate, the assignment was only during the recess of the Senate, one of the extra rooms was surrendered long before the session began and the other was given up within a few days of the opening of the session. It is alleged, however, that the whole investigation was "only a part of the campaign" of the "lobby" and that the Committee, being "entirely friendly to the railroads" lent its aid by calling "a host of witnesses to be quoted to the public against the wisdom and policy of such legislation," as the proposed rate law. This of a Committee which reported the Hepburn bill without amendment and whose Chairman and members, with a single exception, voted for the law now on the statute book. But such a view is ridiculously out of accord with the actual course of the investigation. Professor Frank H. Dixon, head of the School of Commerce, of Dartmouth University, writing for the Quarterly Journal of Economics of November, 1906, said of this investigation:

"This Committee held sessions lasting until May 23, in which railroad representatives, shippers, government officials and students of the question were given an opportunity to be heard. Their report, with appendices, in five volumes, together with the Digest, prepared by Messrs. Adams and Newcomb, is the most valuable source of material in existence on the present problem of railroad control in the United States."

This carefully considered appraisal of the work of the Committee ought to be a sufficient answer to the slanderous misrepresentation of the acts of men of great legislative responsibility by any mere newspaper correspondent or hack-writer for sensational magazines. The reputation of Professor Henry C. Adams, statistician in charge of the statistics and accounts, reported to the Interstate Commerce Commission, head of the Department of Economics of the University of Michigan, and for years a conspicuous advocate of even more radical rate legislation than that proposed by President Roosevelt, is an equally adequate refutation of the silly charge that the "Digest" which he signed and helped to prepare was designed "to show the fallacy of rate-legislation." The further accusation directed against Professor Adams, in this imaginative description of the so-called "lobby," is that he rendered only "trifling assistance" in the preparation of this "Digest." The records show that Professor Adams gave a large part of the summer, practically the whole fall and the early part of the winter to this work, for which he was compensated under a special appropriation which had the approval of both branches of Congress, that he was constantly in communication with the co-author of the "Digest," and that much of the work was performed under his direction in the offices of the Interstate Commerce Commission. He personally prepared a large portion of the text and every word in it was repeatedly gone over by him and has his sanction as well as that of his associate in this work.

The same veracious chronicler of the fictitious "lobby" asserts that "scores of shippers, carefully selected from the ranks of those who were enjoying special favors from the railroads," were brought forward to oppose the legislation. The truth is that every shipper who took this view testified that he was not receiving such favors, and there is practically no suggestion in the whole record that such favors were being granted to anyone, while men like Messrs. Bacon and Cowan, advocates of the bill, declared that rebates were not paid or in issue. He also declares that Governor Cummins, of Iowa, was the "only person appearing before the Committee to present the side of the people as a whole," although the Committee heard Hon. Martin A. Knapp, Chairman of the Interstate Commerce Commission, and his colleagues, Hon. Judson C. Clements, Hon. Francis M. Cockrell, Hon. Joseph W. Fifer and Hon. Charles A. Prouty. If these gentlemen do not represent the "people as a whole," it would be interesting to know whom they do represent. Among other witnesses who would resent the intimation that they appeared to plead for special interests are Mr. Brooks Adams, of Quincy, Mass.; Professor William Z. Ripley, of Harvard University; Hon. Charles F. Staples, Railroad and Warehouse Commissioner of Minnesota; Hon. R. Hudson Burr, member of the Railroad Commission of Florida; Professor Hugo R. Meyer, of the University of Chicago; Mr. T. G. Bush, recently named by President Roosevelt to help administer the Industrial Peace Fund created with the proceeds of the Nobel prize, and Hon. Francis G. Newlands, Senator from Nevada. The Committee published long statements by Attorney-General Moody, President Hadley, of Yale University, and others. As a matter of fact Governor Cummins appeared, not as the representative of the "people as a whole," but, as he carefully stated to the Committee, as the special representative of the "Iowa State Manufacturers' Association." The author of the article under review further volunteers his "personal testimony" to the effect that Governor Cummins was treated with scant courtesy by the Committee. Yet the record shows that the Governor began by expressing gratitude for "the kindness of the Committee," which suspended receiving the testimony of President Ramsey, of the Wabash Railroad, and delayed receiving further testimony from Mr. E. P. Bacon, the representative of the organized advocates of the pending bill, in order to accord him an immediate hearing and that he concluded by saying that he cared to speak no longer "except to express my thanks for the patient and courteous way in which the members of the Committee have listened to my statements." Another statement wholly inconsistent with the facts is that Senator Crane assumed that the "elaborate and learned speech" in favor of the Hepburn bill, delivered by a certain Senator, had been prepared by an opponent of the measure and, on this rather wild assumption proceeded, in open Senate, "for the amusement of his colleagues," to use "every device to lure" the speaker into an extemporaneous debate, which, it is thus insinuated, would have exposed his lack of information on the subject he was discussing. The Congressional Record shows that, although the speech in question was repeatedly interrupted by running debates with other Senators, there was not a single interruption by Senator Crane. Those who are acquainted with the extreme distaste for debate of the distinguished and exceptionally able and influential Massachusetts Senator and know how rarely he obtains the floor for any purpose will rather pity the stupidity of this particular misstatement.

The foregoing illustrations of careless or wilful mendacity have been given merely to typify the general unreliability of the whole article. In point of fact no such organization as its author describes does or could exist, but, as a negative is difficult to prove, the fact is best established by showing the ignorance or absence

of veracity of the author as it appears in the details of his elaborate fiction. Legislation, at Washington or elsewhere, is not to be controlled or influenced, except adversely to those attempting it, by such ridiculous methods as those imagined by this superficial and prejudiced observer and no such fatuous and futile effort was ever made or ever will be made by men of the intellectual strength of those who hold high places in the administration of the American railway system. The contest over the Hepburn rate law was one of the greatest in the annals of American legislation. It brought forth what is generally acknowledged to have been the ablest debate that the Senate has known since the Civil War and it obtained for the public at large a broader knowledge concerning the transportation business of the country than it had ever enjoyed. The railroad owners and managers, who were deeply concerned at the outset, by the apparent threat against the properties they own and administer were neither recreant in their duty to their industry or to their larger obligations as citizens, nor over-assertive in claiming the right to be heard as citizens, as administrators of a great national industry and, even, as property owners. The most advanced and courageous among them, including the great and lamented statesman and patriot who was then at the head of the Southern Railway, and whose recent death constitutes a loss to the Nation and to the South which is irreparable, spoke, from the faith that was in them and for what they believed to be the common good, from every available platform and through every proper agency. Representing thirteen billions of capital; 5,000,000 wage-earners and their dependents; many millions of investors and wives and children of investors, and a large part of the holdings of savings, fiduciary, insurance and guarantee companies the validity of the investments of which is the basis of interests held by more than half of the population of the country; they dared not remain silent. They had special knowledge of the great industry that was attacked, they had spent their lives in learning the transportation needs of the people, and only moral cowardice could have induced them to withhold their advice in this emergency. But they were not alone in their protest against the proposed legislation. Louder even than their voices rose those of the great business, shipping and manufacturing interests of the country. In spite of the systematic organization of every disaffected interest which went on for years and the persistent proselyting of the Interstate Commerce Commission, hungry for more power, it is not too much to assert that 90 per cent. of the traffic movement of the country, represented by those actually paying the freight bills, was strongly opposed to the original proposal of the President

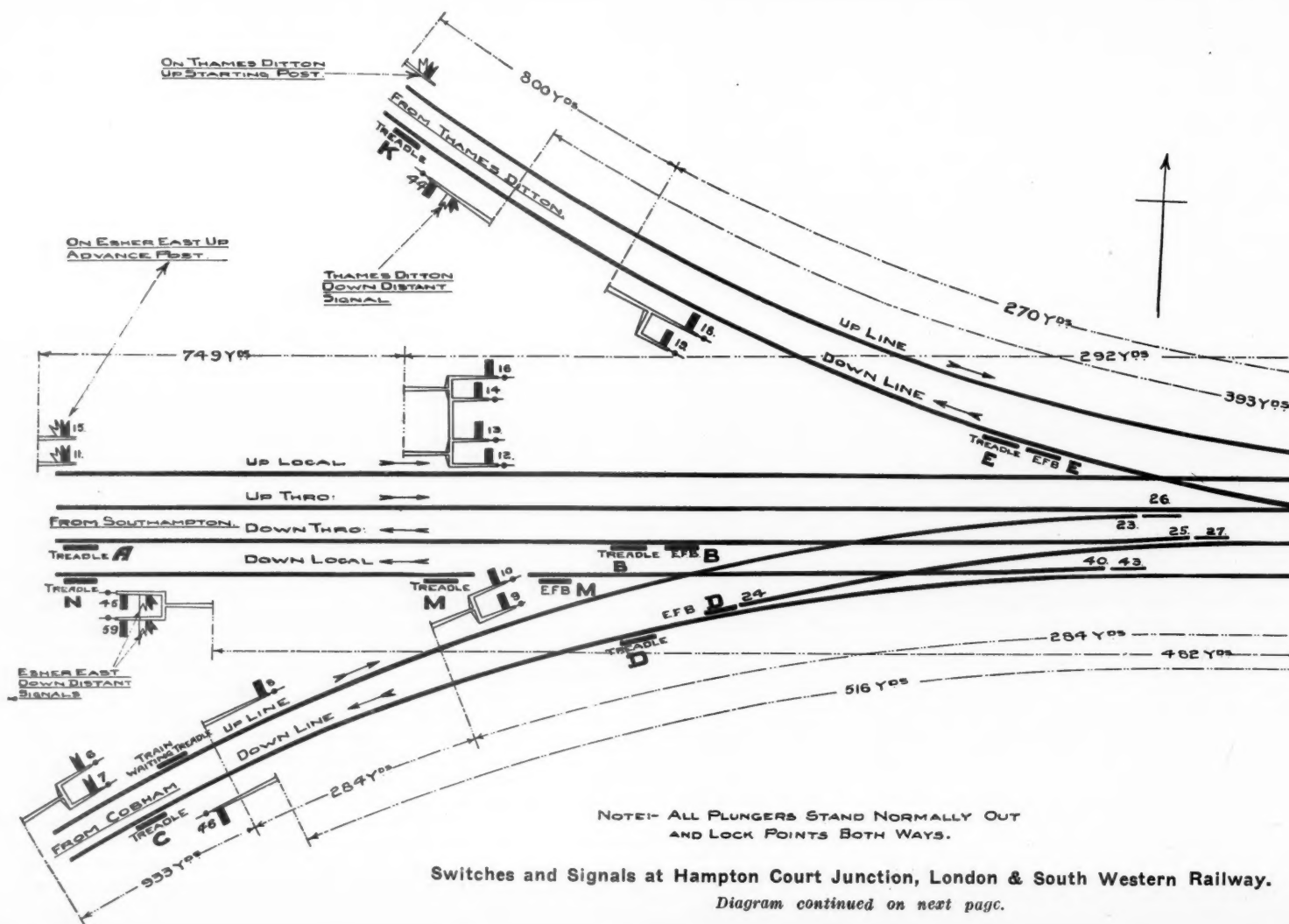
as embodied in the Esch-Townsend bill. This protest was not ineffective. It is to the lasting credit of the shippers, railroad men and students of transportation, who saw clearly and worked patriotically that the proposed control of relative rates, as among competing markets, sources of supply and ports of importation or exportation, was eliminated and the right of every citizen, shipper, community or railroad corporation to its "day in court" was preserved. No "railroad lobby" in the sense in which the term is used by the writer in question, could have done these things, no such "lobby" attempted to do them or anything else in connection with the bill. They were only possible to sincere men earnestly working for that in the justice and wisdom of which they fully believed and then only when great and conscientious statesmen held the keys of legislation and steadfastly refused to be driven from the path of duty by the prejudiced clamor of space-writers, the noise of demagogues, or the pressure of honest but mistaken opponents of the industrial methods and laws under which American progress has been possible. The law is imperfect in many respects, but in so much as it is better than the friendless and abandoned Esch-Townsend bill or the original Hepburn bill, which until it was amended in fundamental particulars had no supporter among either the conservatives or radicals of the Senate; the improvement is wholly due to those shippers, statesmen, railroad officers and students whom the particular muck-raker whose work is under discussion hastens in delight to condemn.

JUSTICE.

Interlocking at Hampton Court Junction, England.

At Hampton Court Junction, England, on the London & South Western, there is an interesting installation of switches and signals which are interlocked mechanically and also locked and interlocked according to an elaborate arrangement, by electric locking, in connection with the station-to-station locking of the "lock-and-block" system. Mr. Arthur H. Johnson, telegraph engineer and superintendent in the Engineer's department of the road, has sent us the drawings and description herewith given. Mr. Johnson says:

In reading the published proceedings of the Railway Signal Association I notice that electrical point locking has been discussed. There appears to be a general impression in America that the British railways have done very little in this direction, which is strange, considering the number of American railroad men who have gone the rounds in this country. The fact is, electrical route locking is applied wherever the controlled manual system is in use. Having



been asked by an old friend in New York to send particulars, I have pleasure in enclosing a diagram of Hampton Court Junction, together with an electrical locking sheet. I do not send the mechanical locking sheet, as that does not differ materially from the American method.

E. F. B. stands for "electrical fouling bar," a bar longer than the car wheel base, and arranged to open a circuit while a train is passing over it. Rear home signal No. 8 with "train waiting" indication is applied owing to "up" trains being worked when necessary from cabin in rear on the "section clear—junction blocked" rule. Trains are not accepted simultaneously on the Thames Ditton and up local lines. The block plungers for these lines, it will be noticed, interlock with points 33 and therefore with each other.

It will be seen by the locking sheet that a train standing at one of the four "Down" advance signals holds the block plunger locked until one of the facing points in its rear is reversed to turn an oncoming train to another line.

If there should be four trains (one at each "advance") then both down through and down local block plungers stand locked.

Hampton Court Junction is no exception, for this is the usual method of dealing with a junction operated under the lock and block.

Table of Electrical Interlocking at Hampton Court Junction.

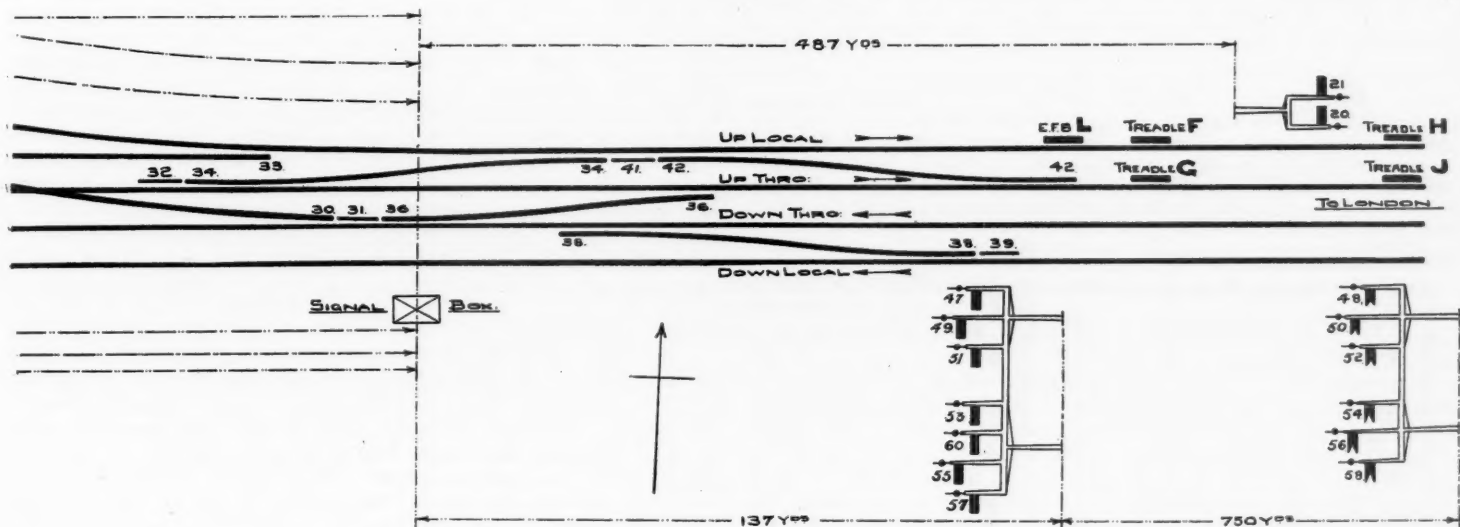
Work.	Released by.	Locking.
8 to pull....	(Preceded by plunger to Claygate)	Plunger to Claygate.
9 to replace.	Treadle G	9, 12, 14, 19, until 20 used.
10 to pull....	(Preceded by plunger to Claygate)	10, 13, 16, 18, until 21 used.
10 to replace.	Treadle F	
12 to pull....	(Preceded by up through plunger)	9, 12, 14, 19, until 20 used.
12 to replace.	Treadle G	
13 to pull....	(Preceded by up through plunger)	10, 13, 16, 18, until 21 used.
13 to replace.	Treadle F	
14 to pull....	(Preceded by up local plunger)	9, 12, 14, 19, until 20 used.
14 to replace.	Treadle G	
16 to pull....	(Preceded by up local plunger)	10, 13, 16, 18, until 21 used.
16 to replace.	Treadle F	
18 to pull....	(Preceded by plunger to Thames Ditton)	10, 13, 16, 18, until 21 used.
18 to replace.	Treadle F	
19 to pull....	(Preceded by plunger to Thames Ditton)	9, 12, 14, 19, until 20 used.
19 to replace.	Treadle G	
20 to pull....	Surbiton west up through plunger.	20.
20 to replace.	Treadle J	
21 to pull....	Surbiton west up local plunger.	21.
21 to replace.	Treadle H	
23.....		Up through plunger.
30.....		Up thro' & up local plunger.
33.....		Thames Ditton plunger.
33 normal....		Up local plunger.
34.....		Thames Ditton plunger.
36.....		Up thro' & up local plunger.
38.....		Down through plunger.
42.....		Up through plunger.
44 to pull....	Fouling bar L being "clear".	44.
44 to replace.	Thames Ditton down plunger.	
45 to pull....	Treadle K	
45 to replace.	Esher, east, down through plunger	45.
46 to pull....	Treadle A	
46 to replace.	Claygate down plunger	46.
46 to pull....	Treadle C	
47 to pull....	(Preceded by down through plngr)	47, 53 (30 when replaced) until 44 used. Down through plunger until 44 used or 30 replaced.
47 to replace.	Treadle and bar E.....	
49 to pull....	(Preceded by down through plngr)	49, 60 until 45 used. Down through plunger until 45 used or 30 pulled or 25 replaced.
49 to replace.	Treadle and bar B.....	
51 to pull....	(Preceded by down through plngr)	51, 57 until 46 used. Down through plunger until 46 used or 25 or 30 pulled. Down local plunger until 46 used or 40 or 38 pulled.
51 to replace.	Treadle and bar D.....	

53 to pull....	(Preceded by down local plunger).	47, 53 (30 when replaced) until 44 used. Down through plunger until 44 used or 30 replaced. Down local plunger until 44 used or 30 replaced.
53 to replace.	Treadle and bar E.....	
55 to pull....	(Preceded by down local plunger).	55 until 59 used. Down local plunger until 59 used or 40 replaced or 38 pulled.
55 to replace.	Treadle and bar M.....	
57 to pull....	(Preceded by down local plunger)	51, 57 until 46 used. Down local plunger until 46 used or 40 or 38 pulled.
57 to replace.	Treadle and bar D.....	
59 to pull....	Esher, east, down local plunger...	59.
59 to replace.	Treadle N.....	
60 to pull....	(Preceded by down local plunger).	49, 60 until 45 used. Down local plunger until 45 used or 30 pulled, or 38 replaced. Down through plunger until 45 used or 30 pulled or 25 replaced.
60 to replace.	Treadle and bar B.....	
Down thro' plunger...		36, 38 until 47 or 49 or 51 used.
Up local plngr.		33 over until 14 or 16 used.
Plunger to Thames Dit'tn		32, 34 until 18 or 19 used.
Fouling bar:		
B.....		Disconnects treadle B.
D.....		Disconnects treadle D.
E.....		Disconnects treadle E.
L.....		42.
M.....		Disconnects treadle M.
Special.—8 Fitted with "TRAIN WAITING" gear.		

Laws for Railroad Safety in Indiana.

The Railroad Commission of Indiana, having been directed by the legislature of the state to make special investigations of the train accidents which occurred at Fowler and Sandford on January 19th, has carried out the instructions and has made a report of 31 pages giving the facts and its findings thereon; and this not only for these two accidents, but also for the collision of November 12 at Woodville on the Baltimore & Ohio. In connection with the report the commission has sent to the legislature drafts of two laws, one to improve the discipline on the railroads of the state and for other purposes, and another to require the establishment of the block system by July 1, 1909, on all railroads earning \$7,500 per mile per year. These laws were passed by the legislature on March 8. Below we give an abstract of the report.

The Woodville collision, which was reported in the *Railroad Gazette* of November 16, December 7 and February 1, was between a westbound passenger train and an eastbound freight, and was caused by the failure of the engineman of the passenger train to give a proper whistle signal to notify the freight, which was standing on a side track, that a second section of the passenger was following. The present report gives few particulars beyond what we have published. The passenger passed the freight at 60 miles an hour. Concerning the whistle the evidence is conflicting; the commission finds the probable fact to be that the engineman of the passenger did give some sort of a blast but those men of the freight who heard it say that they understood it as a whistle for the road crossing. The passenger runner was at fault also for not having his green lights burning and for not stopping to get a response from the freight. Two miles beyond this point he stopped his train and relighted his green lights, but said nothing to the operator there about having



Hampton Court Junction—Continuation of Diagram on Preceding Page.

failed to receive a response to his whistle signal. The commissioners find that by its last annual report the Baltimore & Ohio earned per mile \$14,000 gross and \$5,000 net and, therefore,

"a fair telegraph block system can be installed upon this line in this state at an expense not exceeding the reasonable capacity and ability of this company to pay out of its earnings for one year. The evidence also shows that if the block system had been installed on this line this accident could not have occurred without a violation of the rules and regulations which are now accepted as the best security from accidents of this kind. This line is one of the principal trunk lines crossing the state and has a very dense traffic over a single line where the accident happened. No reasonable excuse has been given why this line could not have long since been protected by the block system. Other lines in this state having less income per mile and a less dense traffic have been so protected for several years, and the commission is strongly of the opinion that the Chicago division of this line in this state should be immediately equipped with a substantial block system."

At Fowler the telegraph block system was in operation; "an excellent system," says the commission, "but one which does not prevent accidents unless the rules are carefully observed." In this case, the passenger train, eastbound, No. 38, is recorded as having made up 3½ minutes in the 6½ miles from Earl Park to Fowler, so that it was probably running 65 to 70 miles an hour. It passed the red light at the station at high speed at 2.15 a.m. and a half minute later collided with westbound freight train No. 95, which was entering the side track. The operator had an order directing the passenger train to wait until 2.17 a.m., by which time the freight would have cleared the main track. The freight had the same order and, being inferior to the passenger train, should have cleared the main track at 2.12 a.m. This it did not do, and the commission finds that judging by the time that they left Swanington the conductor and engineman deliberately used a part of the five minutes.

That the block signal showed red, the operator had good corroborative evidence in the word of the town policeman, who was in the office. Just as the train approached, noticing that it was coming at high speed, Operator Thomas called loudly to the policeman to look at the position of the ropes governing his two signals, eastbound and westbound; and both were in the stop position, where they had been ever since the policeman had entered the office. The train passed a second later, and the policeman went outside to assure himself that the signal light showed red. The policeman testified that the fog was so dense that he could see a switch light only about 100 ft. away. It appears that the engineman of the passenger train was still in the hospital and had not testified.

The commission finds the block signals and switch signals at Fowler "unfortunately located." An engineman approaching from the west finds, first, a switch with a light 19 ft. 3 in. high; then, 100 ft. farther, a switch 7 ft. high; then, 500 ft. farther, the semaphore, 41 ft. 5 in. high, and 25 ft. 8 in. to the left of the track; then, 250 ft. farther, a switch 18 ft. 3 in. high. The semaphore is made high because west of the station there are some trees on the north side of the track, and the line approaching from that direction is descending. On a clear night the light of the lamp can be seen a mile west of the station. On approaching the trees the engineman apparently has the semaphore hidden from him for a short distance; and, in case of dense fog, it is questionable whether he can see it at all when running at anything like service speed.

The commission evidently has heard some criticism of the train order rules and, it is stated, has given much time to examining them; but is not prepared to say that the standard code is not satisfactory.

The commission finds that telegraph operators, in charge of the very vital function of train operation, are in most instances less than 21 years of age, and many of them as young as 17 and 18. The commission

"received expert evidence on the capacity of boys of the ages mentioned to properly discharge the responsibilities which their positions as telegraph operators entail. Eminent specialists gave it as their opinion that neither the mental nor bodily development at those ages fitted the boy for long hours of service, accuracy of judgment or conception of responsibility. The demands of nature are such in boys of those years that they are frequently found asleep at their post of duty, which is an unwarrantable hazard in railroad operation."

Railroad officers appearing before the commission strenuously denied that they wink at violation of the five minute clearance or of other rules. One engineman, apparently a chairman of a brotherhood committee, declared that not only are the rules violated, but an engineman who strictly obeys them "would be regarded by the other men as a sissy and a grandmother." The commissioners, however, do not accept this opinion; on the contrary they quote Mr. George Lamb, an engineman of this road (the Cleveland, Cincinnati, Chicago & St. Louis), who has "a splendid record of 43 years without censure, suspension or dismissal," to the effect that safety is and always has been of first consideration with him and that he had often found it necessary on dark and foggy nights, instead of attempting to make up time, to stop his train and go to the tower or block station for orders; that in such instances he very often reached his point of destination late and that instead

of being censured therefor was commended by his superintendent for exercising proper care.

The commission therefore finds that while a majority of employees are careful, the facts compel the conclusion that many do not strictly obey the rules.

The accident at Sandford, 20 hours after Fowler, and also on the C., C., C. & St. L., was the destruction of a passenger train by the explosion of a car of black powder in a freight train on a side track, the explosion occurring at the moment when the engine of the passenger train passed the powder car. The powder came from Concord Junction, Mass., through Canada over the Grand Trunk Railway. The powder was loaded according to the regulations of the American Railway Association, which are like those of the United States Army, and the car passed under the inspection of the conductor three times between Indianapolis and Sandford, a distance of about eighty miles. The freight had been passed by several heavy passenger trains at high speed. Rain had been falling that night and a very strong wind was blowing from the southwest. The passenger train was not using steam and the brakes had not been applied. The gas tanks of the passenger cars were found after the explosion not exploded, but with all connections broken off. Chemical analyses failed to show traces in the wreck of any explosive more powerful than black powder. The condition of the wreck and of the ground after the explosion gave no evidence of high explosives. If the Pintsch gas had escaped from its tanks before the explosion the high wind would have blown it away from the freight car. There is an oil pipe line a little west of the point of the wreck, but the freight conductor had crossed it with his lighted lantern after the freight stopped, and the engine of the passenger train had not arrived at the pipe line at the time the explosion occurred. A man living five miles from the scene of the explosion thinks that he saw a meteor moving laterally through the sky a few seconds before the explosion, but the commission concludes that he was deceived by the light of the explosion in the sky, this light having traveled the five miles instantly, while the sound took 25 seconds to reach the observer. No person in the vicinity of Sandford observed any electrical disturbance. The commission investigated also the possible action of noiseless electric currents, but concludes that if there had been any such, the steel rails of the track and the telegraph wires would have been pretty sure to carry it to the ground without disturbing the car of powder. After examining the matters here noted, and all other possible evidence and theories, the commission concludes that while it is improbable that any person was in the car of powder, there is more consistency in that supposition, and that such person or persons caused the explosion, than in any other supposition. Parts of two unidentified human bodies were found in a field a thousand feet from the car, but these may have been passengers, or trespassers riding on the baggage car, or may have been pedestrians. Tramps would not be likely to enter a cleared car when other cars in the train were easier to enter.

The first law recommended requires that railroads shall "publish" printed rules, shall examine employees on the rules every six months for a year and a half, and then every year; and violation of this section is a misdemeanor, liable to fine of \$200; that the railroad commission shall call a convention of railroad officers every year to consider the railroad accidents that have taken place during the year, with a view to seeing what shall be done for prevention; that any officer or employee engaged in train operation being or becoming intoxicated while on duty shall be guilty of a misdemeanor and liable to \$500 fine; that the railroad commission, finding that an accident has been due to violation of the lawful rules, may, if the violation is flagrant or due to intoxication, report the guilty person for prosecution; that copies of this law must be posted in cabooses, depots, etc. The law requiring the block system applies only to roads operated by steam power. The commission may extend the time for one year and may exempt branch lines where it shall be made to appear that no reasonable necessity for the block system exists. The penalty for violation of the block system law will be \$1,000 a week.

Federal Laws Challenged.

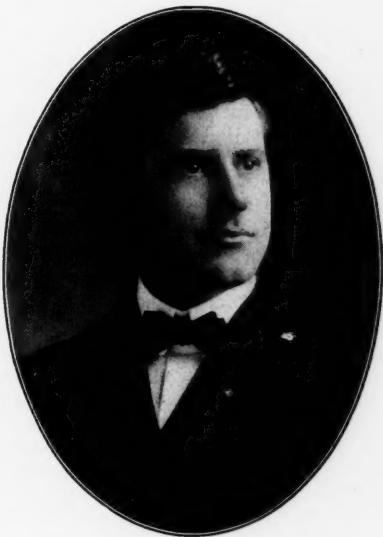
The Ann Arbor Railroad, which has been sued for \$200 penalty for violations of the safety appliance laws, has filed in the Federal court at Toledo a demurrer proposing to challenge the constitutionality of the law. The New York Central has appealed to the Supreme Court of the United States the suit in which it was lately fined \$108,000 for paying rebates. The company charges 101 errors. It is declared that the act is void because it goes beyond the power given Congress to regulate interstate commerce, particularly that it imputes to the corporation power to commit an act with criminal intent; that it is an unreasonable regulation of commerce in making the corporation criminally liable for the acts of its employees; that inflicting punishment upon both the

company and its employee for the same act is in effect double punishment; that it subjects the innocent holders of the company's stock to punishment, and that the sentences are cumulative.

Special Agents of the Interstate Commerce Commission.

The Interstate Commerce Commission, in pursuance of its recent decision that most of the public sessions of the whole Commission shall be held in Washington, has appointed four special agents to represent the Commission in other cities—Messrs. M. S. Decker, L. M. Walter, P. J. Farrell and J. H. Marble. Portraits of these gentlemen are given herewith.* The special agents are to hold hearings in such places as the Commission may appoint, and will have no definitely assigned territory. The idea of appointing resident agents in Chicago and other cities appears to have been abandoned—if, indeed, it has ever been seriously entertained.

Martin S. Decker was born in Rosendale, Ulster County, New York, and began his business life as a clerk in the County Court of Ulster County. He was Clerk of the County and Circuit Courts at Kingston and in other such offices until 1887, when he went to Washington as Docket Clerk for the Interstate Commerce Commission. This was when the Commission was first organized under the original act. In 1893 he was appointed Assistant Secretary of the Commission, and has held this office ever since. He is well versed in the law of transportation and



L. M. Walter.

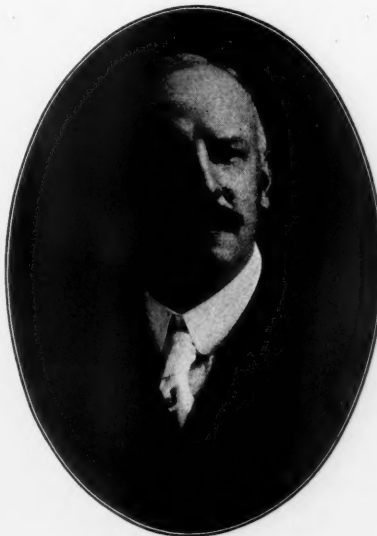
railroad regulation, having done much of the work in many of the important cases that have come before the Commission during the past fifteen years.

Luther Mason Walter, of Kentucky, was born March 2, 1877, and admitted to the Bar April 20, 1898. He worked in the United States Census Office two years and a half, and then for a year was a member of the Board of Pension Appeals. He resigned this place in August, 1903, to accept the position of Law Clerk with the Interstate Commerce Commission. His work has been largely in connection with prosecutions to recover penalties for violations of the Federal Safety Appliance laws. He received the degree of Master of Laws in 1902 and D. C. L. in 1903. In 1904 Columbian University (now George Washington University) made him Master of Diplomacy.

P. J. Farrell, of Newport, Vt., was born May 10, 1861, and admitted to practice in all the courts of Vermont in 1887 as attorney at law and solicitor in chancery. In April, 1906, he was admitted to practice in the Supreme Court of the United States. Mr. Farrell was in the railroad service several years, beginning with the Connecticut & Passumpsic Rivers road in 1880. He was station agent, conductor, clerk in general freight office and train despatcher. He was subsequently a railway postal clerk, and in 1888 he was promoted to be chief clerk of railway mail service, with headquarters at Boston. In 1889 he resigned this place and became law partner of Hon. Charles A. Prouty, now Interstate Commerce Commissioner. He practised law at Portland, Ore., and Newport, Vt., until 1901, when he entered the employ of the Interstate Commerce Commission, where he has acted as attorney in cases before the Commission and in the courts.

John H. Marble, of San Francisco, Cal., was born in 1869 at

*Photographs by Harris & Ewing.



M. S. Decker.



J. H. Marble.

Ashland, Neb., and was educated in the public schools of Nebraska and South Dakota and the University of Nebraska. He was for several years engaged in printing and in newspaper work in South Dakota, Wyoming and San Francisco, and was admitted to the Bar by the Supreme Court of California in 1902. After four years in general practice at San Francisco he came to the Interstate Commerce Commission in July, 1906, beginning as confidential clerk.

Bridges on the St. Paul's Pacific Extension.

The contract for the superstructure for the Columbia river bridge of the Pacific coast extension of the Chicago, Milwaukee & St. Paul was let last week to the Pennsylvania Steel Company. It was for 15 spans, weighing 4,600 tons. Work is under way on the substructure, and it is the present expectation to have it ready for the steel work by the first of next year. The superstructure will be erected by company forces, and the bridge will probably be ready for service within a year from the present time. The McClintic-Marshall Construction Co., Pittsburg, Pa., was awarded the contract for six truss spans for the section between Tacoma and Seattle. These bridges are expected to be ready by fall. The three crossings of the Yellowstone river respectively at Terry, and each side of Miles City, Mont., 12 spans in all, each 270 ft. long, aggregating 6,700 tons, were let to the American Bridge Co. They are being built entirely by company forces, the substructures now being



P. J. Farrell.

under way, and they will be done about the first of the year.

The Missouri river bridge near the eastern end of the line, at Mobridge, S. Dak., as has previously been noted in these columns, was awarded to the Pennsylvania Steel Co. for the superstructure. There are three 425-ft. spans, weighing 4,000 tons. Contracts for girder spans of various lengths, approximating to 1,500 tons each, have been let to the Wisconsin Bridge & Iron Co. and the Milwaukee Bridge & Iron Co., Milwaukee, Wis. Twelve of these are for Musselshell river crossings, three for the Jefferson river, five for the Little Missouri and the remainder for various streams in Montana and North Dakota.

This new line of the Chicago, Milwaukee & St. Paul was described briefly in the *Railroad Gazette* of September 21 and December 14, 1906.

Government Report on the Block System.*

That part of the Interstate Commerce Commission's report on block signals which embraced its conclusions, the mileage table and the chapter on automatic stops, was published in the *Railroad Gazette* of March 1, page 277. Below we give parts omitted at that time.

HISTORY.

The term "block system" is used to designate the method or process whereby, by the use of the telegraph, telephone or electric bells, or by automatic apparatus, each train on a railroad is forbidden to pass a certain point (the entrance of a block section) until the last preceding train on the same track has passed beyond

*Report sent to Congress Feb. 23, 1907.

a certain point farther on (the end of that section). No train enters a block section except and until its engineman sees on the signal post an "all right" signal.

Without the block system, protection from rear collisions depends on the maintenance of a time interval at stations and on elaborate instructions for the use and observance of red flags (or lanterns), torpedoes and fuses, which instructions are often hard to enforce.

Protection from butting collisions (on single-track lines) depends on the exercise, on the part of enginemen and conductors, of most intelligent and unceasing vigilance in the observance and execution of intricate rules and written orders, and on the exercise of the utmost care by the train despatcher, who, by the use of the telegraph, regulates the movements of those trains—on the more important single-track roads a large proportion of the whole—for which the time-table does not prescribe meeting points, which includes all trains when running behind time.

With automatic signals, the passage of the wheels of the train along the track actuates and controls the signals. No signalman is required, and the signals may be fixed anywhere along the line, not necessarily at stations.

The block system as first used in this country, and as now used on thousands of miles of railroad—that is, the "telegraph" block system—is very simple. The agent or operator at a given station sees that a signal indicating "stop," one for trains in each direction, is displayed so as to be seen by the engineman of any train approaching and running in that direction; and this signal is displayed continuously until the attendant operator or signalman has been informed from the next station beyond that the last preceding train on that track has arrived at the said next station, and has either passed on or has been set off on a siding, clear of the main track. This stop signal may be a very simple device so that, with properly instructed station attendants, the necessary first cost of the system is very small.

The introduction of the block system has been slow because under favorable circumstances the old system has done well. With a sufficiently long-time interval between trains at each station, and with rigidly enforced regulations concerning rates of speed and for "flagging back" in case of delay (every delay shortens the time interval between the delayed train and the one following it), trains may be run with a considerable degree of safety by time-table alone, and it is not necessary to have all of the stations constantly manned by a telegrapher. This being so, American railroads, most of them with stations not very near together, were reluctant to increase their expenses even a moderate percentage. With stations far apart, the block system would have required, especially at night, when the small stations were ordinarily closed, many additional telegraphers. The Pennsylvania Railroad was for years the only road using man-operated block signals.*

Not until about 1885 was the manual system used systematically elsewhere, except on a few miles of the New York Central & Hudson River, where the "controlled manual" block system was introduced, from England, about 1882.

Automatic block signals were invented in America and have been developed on American railroads. Although man-operated block signals had been used for some years on English railroads, with their denser traffic, more frequent stations, and lower expenses for attendants, automatic block signals found more pronounced favor in this country; and the Eastern Railroad of Massachusetts (now the Boston & Maine) had 16 miles of its line near Boston equipped with automatic signals in 1871. Other New England roads followed, so that by 1878 there were automatic signals on a considerable mileage in the vicinity of Boston. In the next year, 1879, the track circuit, a radical improvement, was introduced on 10 miles of the Fitchburg Railroad, near Boston; and from that time automatic signals made steady though rather slow progress. Though there was not in this system the cost of additional station attendants, as in non-automatic block signals, the cost of installation of apparatus and fixtures was high, as was also the cost of inspection and maintenance; therefore, only companies enjoying a heavy and

profitable traffic deemed it wise to equip their lines with automatic signals.

Except on a few lines, block signals were introduced only where the dense traffic compelled an improvement on the old system. For many years some roads which had made considerable investment in automatic block signals continued to maintain their time-interval rules, using the signals as an auxiliary protection. On a few roads, however, far-seeing and discriminating managers who saw that the potential value of the space-interval principle was greater than appeared from the cold calculations based on volume of traffic and on the earnings or expenses for single years, introduced the telegraph block system on lines where the volume of traffic did not compel its introduction. That is to say, the trains were not so frequent as to require a shortening of the time interval to increase the capacity of the road. Some of these managers were, indeed, impelled to make this change because of large expenses due to the damages caused by collisions.

One of the most significant things in connection with the progress of the block system during the past few years has been its use on long lines of single-track railroad. On lines of this kind its use is now so general that the propriety of adopting the system for lines of any grade may be looked upon as a generally accepted principle. There are not wanting managers who had delayed the introduction of the system until it could be shown by statistics that the added expense would be warranted and have found such statistics only in connection with a long list of killed and injured passengers, the victims of a collision.

COST.

Like many other items in the operation of a railroad, the cost of the block system is a somewhat indefinite quantity. Few roads have introduced the system in such a way as to keep its cost separate from other expenses. Except on a new line, the significant item is the excess of cost above what was paid for train protection under the old system. Usually the first cost of introducing the telegraph block system is confined to one additional telegraph wire, say \$30 per mile, and a signal, say \$75 or less, at each station. On many lines the train-order signal already in use for train despatching has been made to serve satisfactorily as a block signal. The real financial burden, if any there be, is in the additional telegraph operators required, making a permanent increase in the pay rolls. On one road on which the telegraph operators already in service managed the block signals, the increased expense for wages of operators (for additional operators) was less than 5 per cent. There are numerous examples similar to this. The cost of an additional telegraph wire is too small to receive special consideration.

On the other hand, a road which erects signal cabins specially for block signals, and employs signalmen independent of its existing telegraph service, will expend \$500 each for the cabins and from \$1,200 to \$1,500 yearly for wages, fuel and maintenance at each. With block stations three miles apart, these items would thus aggregate \$16,666 and \$40,000 to \$50,000, respectively, for 100 miles of line. Whether the stations are three miles apart, or more or less, depends, of course, on the volume of traffic and the required frequency of trains; so that no universal rule can be laid down.

The cost of the electric apparatus for "controlled manual" has been looked upon by most roads as unwarranted. Only roads with heavy earnings are using it. The "average" road acts on the theory that with competent signalmen the "control" is unnecessary. The justification of this position depends on the results; and results may not be visible until after a term of years, for the reason that signalmen not fully competent may work for years without causing a collision.

In considering the installation of automatic block signals, the first financial question is the original cost of the signals, apparatus, fittings, and appliances. The cost of maintenance, while a considerable item, is decidedly smaller than the cost of operation of the non-automatic systems, in which the item of wages is large. Automatic block signals have involved expenditures of from \$1,500 to \$3,000 a mile of double-track road, the precise figure varying according to the type of signal the number of outlying switches to be connected, and the frequency of the signals or length of the block sections. The maintenance of these signals costs variously from \$75 to \$125 per signal per year. Until within two or three years automatic signals have not been introduced except on lines of considerable traffic, where the necessity for running the passenger trains closely following one another was considered pressing. One important exception to this statement is the case of the Cincinnati, New Orleans & Texas Pacific Railway, which has used these signals on its single-track line for long distances for 10 years or more. At the present time this road has about 300 miles of single track alone equipped with automatic signals. During the past year or two the Southern Pacific has taken similar action—has ordered automatic block signals for hundreds of miles of single-track lines.

That but few other roads have adopted automatic signals except on very short lengths of single-track line—the reason that the two roads just mentioned are exceptional—appears to be based on the fact that for single-track lines the automatic system does not

*The first block signaling in America appears to have been on the line between Kensington (Philadelphia), Pa., and Trenton, N.J., in 1863 or 1864. This statement is based on the testimony of the late Robert Stewart, who was superintendent of telegraph of that road at or about that time. The space interval was adopted after the occurrence of a disastrous rear collision of eastbound extra trains at night carrying soldiers from the seat of war to New York and New England. The block system was extended northward from Trenton to New Brunswick some time in 1864. The earliest date of which an authentic record has been found is Nov. 12, 1869, which appears on a circular issued by F. Wolcott Jackson, general superintendent of the New Jersey Railroad (Jersey City to New Brunswick), and dated at Jersey City, N. J., giving the rules under which the space interval was to be maintained. The circular is signed also by R. Stewart, superintendent of telegraph. The block system was put in effect from Frankford Junction westward to Mantua (West Philadelphia) in 1870. In 1872 the Pennsylvania Railroad took control of all these lines, and at that time a length of 90 miles was being worked by the block system. In a statement made by Mr. Ashbel Welsh, in 1866, he speaks of the block system as having been in use for a year between Jersey City and New Brunswick. The block signals consisted of banners in boxes, some of which have been in use until within a few years and may be familiar to the reader. The box stood on a post, and red flannel banners were dropped in front of a white surface or white light for the stop indication. On some of the boxes there were hoods to prevent impairment of the engineman's view by the rays of the sun reflected from the glass which covered the opening in the front of the box and protected the banner from the weather.

afford all of the safeguards that are needed. Notwithstanding a full equipment of signals it is necessary to continue in force the time-table rules regarding the meeting of trains and train despatchers' authority and oversight to provide for the meeting of extra trains and of regular trains when behind time.

One or two companies have introduced automatic signals on single-track lines where the telegraph block system has been in use and is continued in use. This is to facilitate movements where it is necessary that a considerable number of trains, usually freight trains, must follow one another in the same direction at short intervals. The telegraph block system is worked with facility only between meeting points; that is to say, between block stations fixed at the sidetracks where trains can meet and pass. These are usually three miles or more apart, while by the introduction of the automatic signals provision can be made for the protection of trains running in the same direction much less than three miles apart.

Where trains are so frequent that a time interval of five minutes or more cannot be tolerated, the automatic system is now generally deemed the only suitable system, because where trains must follow one another as closely as once in five minutes the block signals must be not over two miles apart; and with this interval the cost of the manual block system would be very high.

From a humanitarian standpoint the block system is to be regarded simply as a safeguard against collisions of trains, but it is much more than that, for it is an effective means of increasing the capacity of a railroad. On lines where the traffic is dense or even moderately active, the use of the block system permits the running of trains near together at full speed. The running of successive trains within two minutes of one another may be safely permitted under a properly operated block system; whereas, in the operation of lines where the block system is not used, it is necessary to maintain a time interval of from five to ten minutes between trains except where the speed is very low, as in the case of some freight trains. The block system thus increases the capacity of the road and serves, in some degree, to postpone the day when additional main tracks must be built at great expense. This is a fact that must be taken into consideration in any proper estimate of cost.

SAFETY.

The broad question of the safety of the block system needs no discussion, but it will be proper to consider somewhat more in detail the relative merits of the different systems, considering each by itself and in comparison with the other systems. It is obvious that the system generally, whether telegraph or automatic, is safer than the time interval and despatcher system, because fewer collisions occur under it. Nearly all of the large railroad companies have adopted it to a considerable extent, and they are putting it in use on additional lines year by year. Whatever may be their conclusion as to the precise measure of economy, they do this avowedly to promote the safety of the lives and limbs of passengers and trainmen.

The block system provides that each engineman may, with perfect safety, start and run his train by the sole authority of a visible signal, fixed on a post at the side of the road, which gives him the exclusive right to the track for a given distance (to the next block signal) without limitation as to the time to be spent in getting there, or the speed. The system provides all necessary security against collision, with no question about the importance of the train, or the priority of any other train. So far as safety is concerned, all trains are of the same class.

Without the block system, the right of a train to proceed depends on the class of the train as regards other trains; on the time, as shown in the time-table, and on the vigilance of the engineman in seeing that the preceding train is out of his way. Under the block system these otherwise vital features become matters merely of convenience or expediency. With no block system rear collisions are provided against by flag or lantern signal, but the failure of this safeguard is notorious. It fails both from the negligence of flagmen to carry out or display the signal, and of enginemen to heed it when it is given. On a single-track line, in addition to these uncertainties, the men in charge of trains have the burden of considering their rights as against trains coming from the opposite direction, which are of two or more different classes, and the superiority of which as related to their train may vary from hour to hour, or may be varied by telegraphic orders from the train despatcher at any stage of the train's journey. Butting collisions due to confusion in these things—to mistakes in reading the time-table, to wrong telegraphic orders, to non-delivery of orders, to forgetting orders and other blunders—are as notorious as are rear collisions from flagmen's failures.

On either double track or single track we have on the one hand (in the block system) fixed signals, situated at known locations, few and simple requirements, and few men to share the responsibility of any given operation. On the other hand, we have in the old system, signals (as flags), not fixed but to be encountered at unexpected places, or no signals at all, compelling dependence

on the time-tables, watches and confusing rules of superiority. Responsibility is divided among a larger number of men.

It is therefore not necessary to be acquainted with the details of railroad working to decide which must be the safer method of operation.

The engineman who makes a mistake under the block system usually finds himself condemned by all competent critics, with little palliation, because the problem under which he breaks down has been simplified to the last degree; whereas mistakes made under the other system (forgetfulness, mistakes in reading poor handwriting, errors in adding and subtracting hours and minutes, neglect of some rule that rarely affects him) are of a kind that enlist sympathy by reason of the general appreciation of the great difficulty of surely avoiding such mistakes 365 days in the year, one year after another.

Every railroad company finds evidence of the superiority of the block system in the record of collisions, regardless of all theoretical arguments. A few roads have informed the commission that by the introduction of the block system their expenses for collisions have been reduced. One makes the definite statement that this reduction—1906 compared with 1896—was 45 per cent., notwithstanding a great increase in the volume of traffic, which increases the dangers. It is undoubtedly true that but for the use of permissive blocking for freight trains a part of the time, which involves a virtual suspension of the block system, this percentage of saving would have been much larger.

There is no escape, therefore, from the conclusion that the block system is the best known instrumentality for the prevention of collisions, notwithstanding the imperfections which have been shown in the results of its operation, and that the highest standard, both of the public requirement and of expert railroad opinion, calls for its general use. The most progressive railroads are using the system extensively and are extending it, and their signal engineers and operating officers are constantly striving to make it more perfect.

Considering now the question of safety more particularly and looking at each method of signaling by itself, we will take first the "controlled manual." For the reason that comparative statistics of safety are not to be had in authentic and lucid form, the question of safety must be decided in all of the systems largely by a critical examination of the apparatus, the principles of the system, and the methods of administration.

The Controlled Manual.—This system is the safest known. All signal operations are made by regular attendants in the signal cabins, and the man (A) giving a clear signal must always have the co-operation of the one (B) at the other end of the block section. The movement of the train itself also checks the operation of A. In some few installations the last-named safeguard—that depending on the movement of the train—is made constant during the passage of a train through the whole length of the block section by having a track circuit throughout the section. This secures the advantage both of human attendants and of the self-acting machinery of the automatic block system. There can be no question that in this system false clear signals due either to errors of signalmen or faults of apparatus are fewer than in the telegraph block system or in the automatic system; though it is fair to say that, because of its mechanical refinements (deemed an extravagant expense because of the infrequency of the errors that it is designed to prevent), the controlled manual in its complete form has not come into extensive use. For this reason the superiority of this system cannot be compared with that of the others on a satisfactory basis.

Errors of enginemen are probably neither more nor less frequent with this system than with the telegraph block system, though there are no available statistics on the point.

The Telegraph Block System.—Faults of apparatus are in this system too rare to merit attention in this place. The question of safety as compared with the other system hinges on the efficiency of the signalman. Considering the controlled manual system as the standard, this system is inferior by reason of the chance that a signalman will give a wrong signal because his error or neglect is not invariably checked by any other person, nor by any electrical machinery. Looking at the accident records compiled by the commission for the last two years, July 1, 1904, to July 1, 1906, it appears that of the 160 rear and butting collisions which were deemed "prominent" and entered in class A (persons killed, 507; injured, 2,597) 13 occurred under the telegraph block system.

All of these are charged to the negligence or misconduct of signalmen, and none primarily to faults of enginemen, though in one case an engineman disobeyed a rule designed to provide against signalmen's neglect. In the same two years seven collisions in class A on lines worked under the automatic block system were reported as all due to misconduct or neglect of enginemen. These figures tend to indicate that in its feature of monitorship the telegraph block system has a marked advantage. The presence of the attendant at or near the signals keeps the engineman wide awake and attentive to the signal indications. The causes of the signal-

men's errors in these 13 cases are various. Inexperience and culpable neglect—the latter apparently a grave moral defect—are the two most prominent.

Without the fuller statement of facts which an inquiry on the spot would furnish, a closer analysis of this accident list cannot be made; but there can be no question that the number recorded (13) is far smaller than would have been the case had the block system not been in use.

In aiming to define or even to discuss a standard of perfect safety, human fallibility cannot be ignored, as the mysteries of the "personal equation" have never been fathomed. However, should the "control" apparatus be regarded absolutely necessary in manual block signals, the record of the British railroads must be considered. Most of their lines have no "control," yet the records show that collisions are rare. Again the introduction of machinery to check the errors of men cannot be fairly accepted as a justification of neglect to use any well-known means of preventing human errors by wise selection and adequate discipline. The British Government inspectors have discussed "control" but have never formally recommended it, or given any decided opinion in favor of its general use.

The facts of the accident records justify a strong presumption that American signalmen are not so carefully selected nor so well trained as those of England. The average signalman in America is young, and has had, probably from six months to two years instruction—not systematic training—under another signalman, whose superiority to the student is due entirely to what he has learned by experience and not at all to methodical and authoritative instruction. The average block signalman in England, on the contrary, has served as such from five to 25 years and has been through a long course in a signal cabin as "booking boy," or as assistant, before being trusted with full charge of the block signals. This difference in personnel of the signalmen of the two countries undoubtedly explains in large measure the nearer approach to perfection of the block signal service in England. The fact that youth and inexperience are factors in our "failures in block working" has been repeatedly illustrated in the accident records, as given in the quarterly bulletins. A more searching study of this feature of the practice in this country would involve detailed inquiries in many places. So long as the telegraph block system is worked anywhere with a higher degree of safety than on American railroads, the practice of American roads to the extent of such superiority must be declared deficient. The commission knows of no American who has made an extended examination of the men and methods in English signal cabins, nor of any Englishman who has studied the practice in America, but such brief and partial studies as have been made confirm what is here said.

The Automatic Block System.—The basic block-signal principle applies to the automatic and the non-automatic alike. Considering the distinctive features of the automatic, we have to deal primarily with the behavior of apparatus and fixtures instead of with the acts of men. A number of railroads have records showing only one dangerous failure of apparatus in millions of movements. These railroads are the busiest in the country, and these signals have been in use from five to 20 years. Faults of apparatus, where developed, have been diligently investigated, and constant progress has been made; the manufacturers of signals and signal apparatus co-operate with the railroads in seeking perfection, even at great expense.

Nearly all of the larger roads operating the busiest lines show by their acts that they deem the automatic system preferable to the non-automatic. One prominent road, the Pennsylvania, is constantly introducing the automatic on its lines of heavy traffic in place of the telegraph block system. The automatic signals have thus already superseded the telegraph block system on lines where the latter had been in use 25 or 30 years. Errors of enginemen constitute the most prominent fault in the automatic system. Faults of apparatus are considered under another head.

DEFICIENCIES OF THE BLOCK SYSTEM.

The complete space interval system is sufficient for all demands of any possible train movement. The time interval is partial. It has to be bolstered up by the red-flag system, and the flag has to be bolstered by the torpedo. But we must recognize all known deficiencies of the block or space system and thus avoid cherishing extravagant expectations of perfection.

Under the telegraph block system an operator may omit to record the passage of a train or to advise the next block station; he may clear the signal for a certain track without first looking out of the window to see if the track is not obstructed near his cabin by another train. Unless the standard of selection and discipline is high, moral faults come in, such as allowing inexperienced persons to perform responsible duties, or going to sleep with signals in the clear position. (Signals when not in use are to be left in the stop position, which provides against danger from a sleeping operator; violation of this rule is therefore to be classed as a moral fault.)

An element of weakness in the system as worked on many railroads is found in the long hours of service. A great majority of the signalmen on American railroads are required to be on duty

12 hours out of the 24, and seven days in the week. This is a practice which must be a violation of true economy, except possibly in cases where the work is very easy and hours off are freely granted. Most men who are of sufficient intelligence and moral character to make thoroughly satisfactory block signalmen will naturally seek a respite occasionally from such a confining routine, and if they cannot accomplish this without securing a substitute at their own expense they are under constant temptation to "change off"—the day man working for the nightman and the nightman for the day. If they can do this they work more than 12 hours without adequate intermission, which, in such delicate work, is a reprehensible practice.

Errors of enginemen, though rare under the telegraph block system, must be recognized. In spite of the monitorship of the signalmen, enginemen do sometimes run past stop signals. These errors occur usually in the night or in a dense fog, but in probably 99 per cent. of such cases the engine runs beyond the signal only a short distance. Against this chance of collision there is a rule requiring the signalmen to forbid the starting of a train from A to B until the last preceding train has passed some distance beyond the signal at B, say 300 ft. These errors of enginemen are mostly due to allowing enginemen to run in districts with which they are not thoroughly familiar or to lax discipline.

The faults of automatic signals are largely non-dangerous—that is to say, they may cause a failure of a signal and thus delay one or more trains, but involve nothing worse than delay. To recount these faults would be chiefly a technical essay showing how well the signal engineers and designers have succeeded in eliminating faults and perfecting the system. By successive improvements, following the lessons of experience, failures of batteries, breakage or crosses of wires, and other mishaps have been so controlled that they always set or retain the signal in the stop or danger position.

Dangerous failures of apparatus are those which cause a signal to indicate "proceed" when the block section is not clear. When a train enters a block section, the block-signal arm indicates "proceed." By the passage of the train over the rails, it is caused to move at once into the position to indicate "stop" to the next following train. This is accomplished by the reduction of the force of the electric current flowing through an electro-magnet. This allows the armature of the magnet to drop through the space of a small fraction of an inch. If the armature should fail to move freely in its bearings, or if, in consequence of lightning or some other foreign electric current, the magnet should continue to exert its attractive force, or if the small space should be closed (in freezing weather) by condensed moisture or any substance forming an electrical conductor, the signal would continue to indicate "proceed," and this would permit a second train to enter the block section already occupied by the first one. If then the first train should be unexpectedly stopped, there would be a collision unless (a) the engineman of the following train should see the rear car in time to stop, or (b) the flagman of the train that had stopped should get off and go back and signal the oncoming train. As to the engineman, he might be prevented from seeing ahead by a curve in the line, or by fog or falling snow; and flagmen, from various causes, often fail to perform their duty. If trains follow one another at very short intervals and at high speed, a flagman may be unable to stop a following train even when doing his best. Knowing that the block signals are almost perfect, he will shirk the task as unnecessary, unless his devotion to duty is of the highest grade. The rules specifically require the flag protection (with both automatic and man-operated block signals) and thus theoretically provide against collision from any failure or wrong indication of the block signals, but the coincident failure of both the block-signal protection and the flag protection must be recognized.

At the same time it is fair to observe that these dangerous failures of automatic block signals are exceedingly rare. Collisions by reason of them are still more rare. One company reports that in a period of five years certain automatic block signals were operated 19,000,000 times, with only two dangerous failures. Other companies could give reports nearly as good, probably; but many of the roads say they have no satisfactory records.

The faults of enginemen respecting signals are largely susceptible of correction by rigid discipline. The more progressive roads have introduced "surprise checking," by which if an engineman has fallen into the careless and dangerous habit of assuming that a signal will be all right, and thus approach it at such high speed that he cannot stop when it is against him, he is detected and called to account. This is done by sending out inspectors to put the signal in the stop position when, so far as safety is concerned, it might be in the proceed position. There can be little doubt that of the seven collisions before referred to, most or all would have been prevented or greatly mitigated if this means of enforcing discipline had been in use.

On some single-track roads, where the telegraph block system has been introduced on the cheapest scale, a deficiency in the protection of train movements at the smaller stations appears also in another feature, namely, the use of a single signal opposite the tele-

graph office in place of two signals, one at the approach to the station yard and the other at the outgoing end of it. This single signal being used to stop trains which must, for convenience, stop with the engine several hundred feet beyond the signal violates the fundamental principle that the stop required by a stop signal must be either exactly at the signal or at some point short of it. While, with this single-signal arrangement, and with switches not interlocked, the block system is incomplete, the fact remains that by suitably modifying regulations and by good discipline, the block system still serves well in its chief function, the important and essential one of preventing collisions between stations.

Before leaving this branch of the subject, mention should be made of the necessity for interlocking. While many of the more important trunk lines are measurably well equipped with both block signals and interlocking signals, which may be called twin safety devices, there are many hundreds of miles on which the block system is used with a fair degree of success, although the interlocking is not complete.

The term "interlocking" is used to designate the arrangement of switches and signals at junctions and crossings by which the attendant is prevented from giving conflicting signals—from permitting trains on two or more converging or crossing lines to come into collision with one another and from giving any signal to pass over a switch until the switch is in a safe position. The signals are the same in appearance as block signals, but in their construction provision has to be made for indicating to a train not only that it may proceed but over which of two or more diverging tracks it is to proceed. If the switch at a junction or cross over is not suitably interlocked with signals, and with distant signals when necessary, the safe passage of trains past such switch depends on rigid adherence to regulations, and on the vigilance of the en-

the wheels of the engine and the rails of the track with an outside controlling circuit, which in turn is controlled by the track relays or equivalent devices for the next block section ahead. As the train passes each of these points, if the block ahead is clear, the circuit of the relay on the engine remains unbroken and the lamp indicating "clear block," which has been burning since the last point for the actuation of the relay was passed, continues to burn, but if the block ahead is occupied the relay circuit is broken, the lamp indicating clear is extinguished, and the lamp indicating stop is lighted.

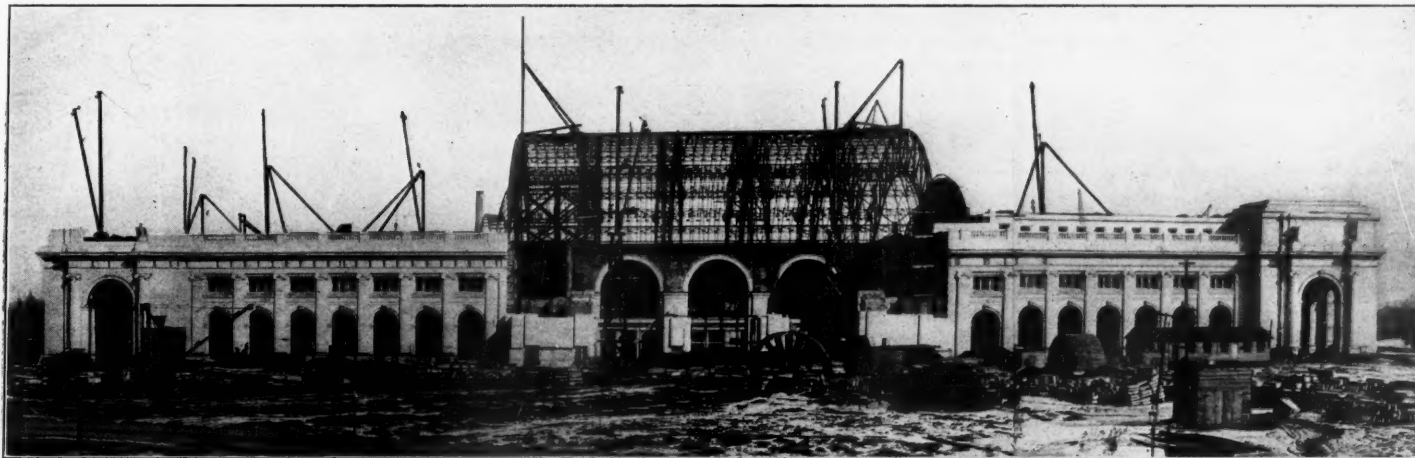
As applied on the Harlem Line the system was worked as an adjunct to the ordinary roadside block signals already in service. It is understood, however, to be designed for use without other signals, as a complete system in itself.

(To be continued.)

Progress of Washington Union Station.

The new Union Station of the Pennsylvania and the Baltimore & Ohio at Washington, D. C., and the progress of its construction has been described in the *Railroad Gazette*, December 4, 1903; January 15, 1904; June 3, 1904; November 11, 1904; April 21, 1905; April 13, 1906 (page 109, General News Section) and August 3, 1906. The last of these articles was a particularly full and detailed description of the progress of the work up to the middle of last summer. The advancement since that time may be seen by comparing the accompanying photograph of the main station building taken on Feb. 22, 1907, with the photographs in that article.

It is worth while to briefly review the main features of the undertaking. The cost of the new station and approaches will be about \$20,000,000. The work is being done by the Washington Ter-



Front View of Washington Union Station, Feb. 12, 1907. Granite and Brick Work in East Wing Finished; in West Wing 80 Per Cent. Finished.

gineman; and if such a switch is situated within the limits of a block section, the block system is to that extent imperfect. The same is true of a crossing, where one railroad crosses another at grade.

If there are not suitable interlocked signals, which are made a part of the block-signal system, the signals of the block system give only a conditional right to proceed. Likewise a drawbridge, if not interlocked with the block signals, constitutes a break in the block system, which is not provided for except by modifying provisions in the rules under which the block system is worked. There are many lines on which there are both crossings and drawbridges, as well as numerous switches, which are not suitably equipped. At a drawbridge or a crossing in this condition, trains are required to come to a stop, thus providing against wrong movements by putting a rigid limit to the speed of all trains.

On roads where the side-track switches are not interlocked, which is the case at many of the smaller stations on some lines, the safety of trains as regards the danger of misplaced switches depends on the old rules and on a vigilant lookout on the part of the engineman. On such lines the block system is useful mainly in preventing collisions on the open road between stations.

LOCOMOTIVE CAB SIGNALS.

A locomotive cab signal was in use for some time (1902-1906) on the Harlem Line, partly in tunnel, in Park avenue, New York City. It is by this line that the trains of the New York Central & Hudson River and the New York, New Haven & Hartford Railroads enter New York City.

In this system the signal indications are given by colored electric lights in the cab. The circuits of the lamps are controlled by a relay similar to that used on the track circuit. At certain predetermined points along the line the circuit that includes the winding of the electro magnet of the relay comes into connection through

minal Company, which is owned jointly by the Philadelphia, Baltimore & Washington and the Baltimore & Ohio. James McCrea, President of the Pennsylvania, is President, and Hugh L. Bond, Jr., Vice-President of the Baltimore & Ohio, is Vice-President. George W. Martin is Superintendent. The engineering departments of the two roads are represented by Robert Farnham for the Pennsylvania and W. F. Strauss for the Baltimore & Ohio. The site of the new station is just northeast of the Baltimore & Ohio passenger station and four blocks north of the Capitol. It will require little change of tracks to bring the Baltimore & Ohio tracks into the new station, but in order to give an entrance for the Pennsylvania a new branch has been built from Magruder, Md., on the present main line from the north to Washington southwest six miles to the new station. To connect the station with the roads to the south a tunnel has been bored under Capitol Hill connecting with the main line of the Philadelphia, Baltimore & Washington, and over it with the Richmond, Fredericksburg & Potomac. The present line between Magruder and the junction of this tunnel line is to be used for freight only.

The progress of the work may be summed up as follows: Most of the material for the plaza, and for raising the radiating streets to the new grade has been delivered. There have been 40,000 cu. yds. of masonry put in the foundation of the head house; 1,000,000 cu. yds. of clay, sand and gravel deposited on the site, and over 2,500,000 cu. yds. of material excavated during the past three years. Originally the station site was low, undesirable land, about 25 ft. above tide. This has been raised by filling to be nearly 60 ft. above tide with gently sloping approaches, insuring good drainage.

Severe weather this winter has greatly interfered with the general progress of the work which, along certain lines, has been at a standstill. On the station building, bricklaying and granite setting have been seriously delayed since the middle of December. The outside granite work of the east wing of the station is finished

and about 80 per cent. of the west wing in place. Less than 30 per cent. of the granite and brick work for the main entrance has been placed, due, until recently, to difficulty in securing base blocks from the quarries. All the interior granite work is finished except a little in the ticket lobbies. Most of the remaining granite has been cut and delivered and granite work should be finished within three or four months. There is about 250,000 cu. ft. of this in all, of which total about 80 per cent. is in place and about 75 per cent. on the site, making about 85 per cent. of the whole completed.

There are to be about 13,000,000 common, pressed and enameled bricks used, of which about 90 per cent. are in place. About the same amount of the 7,500 tons of steel in the head house is erected in place as against 75 per cent. in July; the remaining 10 per cent. belonging in the extreme west end of the building over the carriage porch and in the roof over the general waiting room. The height of the steel roof trusses over the general waiting room is about 120 ft. above the general floor level.

The ornamental iron work in the stairways, windows, doorways and large semi-circular openings in the general waiting room has advanced as fast as other conditions would allow, and is now 80 per cent. in place with additional fabricated material at hand. The carpentry and glazing work has not progressed as fast as the other work, but has been finished in the east wing as far as it was possible at the present stage of construction. The roof of the east wing is finished, except for some work on the skylights. The concourse and dome of the general waiting room are to be covered with concrete tiles which are being manufactured on the site at the rate of 1,500 sq. ft. a day. The copper and sheet metal work on the skylights and valleys is being put in position. The concrete slabs on which the concrete roof proper will rest are all in place, and waterproofing material has been applied over most of the area. The skylights in the concourse roofs are now being put in. Including finished roofs and labor in preparation of the roofing material, about 60 per cent. of this class of work is finished. Little work has as yet been done on concrete floors. This is due largely to the fact that small floor space was available before winter weather set in.

The laying of concrete floors and setting up of concrete partitions has been resumed with warmer weather. A complete system of conduits for electric wires is being installed throughout the station and concourse. This is about 60 per cent. done. About 90 per cent. of the ornamental terra cotta work and about 70 per cent. of the fireproofing terra cotta is in place. The heating, ventilation, plumbing and drainage systems are now finished except for installing fixtures which cannot be put in place until floors are laid. The foundations for most of the shelter sheds in the train yard have been laid and nearly all the drainage pipes put in. The cast-iron columns for about 30 per cent. of the sheds are on the ground ready to set up. The tracks on the low level have been laid and partly ballasted.

In the power house the structural steel is now almost all erected and all the heavy retaining walls and foundations finished. The masonry construction in the building proper has been started. Some of the machinery has been received and installation is well under way. The pipe work between the power house and the station and the express building is about 75 per cent. finished. The power house stack, 275 ft. high, shown in the accompanying photograph, is finished, except for placing in position the cast-iron draught flue. All express matter will be handled in a separate express building in which nearly all the heavy steel work is erected. The brick work in the south two-thirds of the building is 90 per cent. finished and nearly ready for the steel work in the roof.

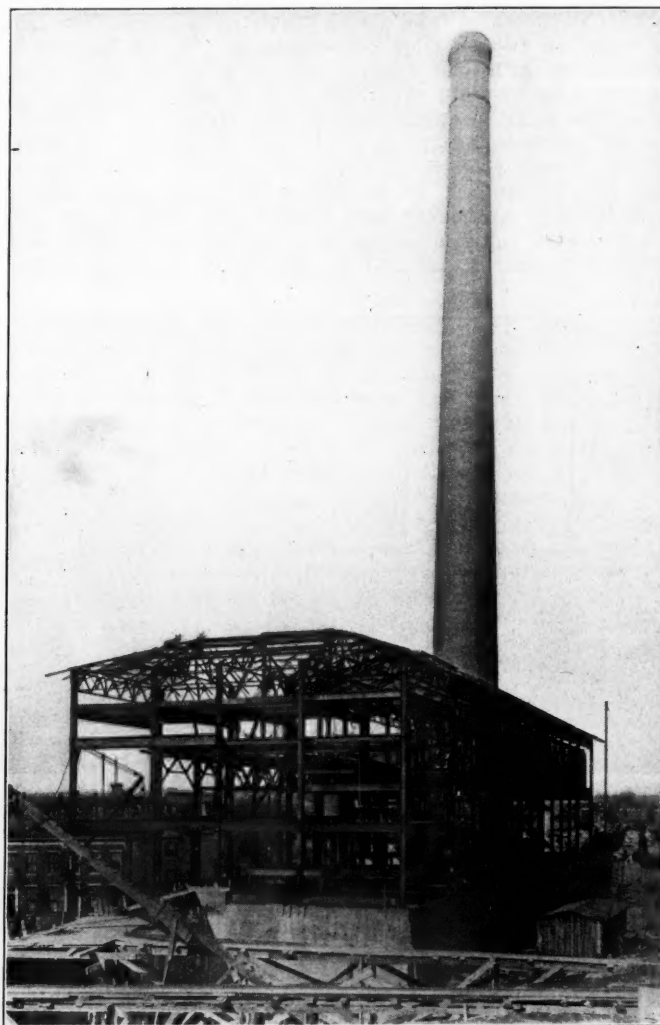
On September 30, 1906, the traffic of the Baltimore & Ohio was thrown over to the new tracks between Langdon and New York avenues. Since then the gaps in the masonry walls, forming the limits of the terminal at I street, have been closed, except for a little masonry in the west wall between the inspectors' building and H street. The filling in this part of the work has been finished except for the space immediately east of the power house and the inspectors' building which, up to lately, has been occupied by contractors' material. The property owned east of the station has all been filled to approximately the newly established grades of the streets leading to the plaza.

The steel work in the New York avenue bridge has been finished and jacketing begun. The back wall and coping of the abutment have been finished and forms for finishing the west abutment back wall and coping are now being made ready. Little work has been done on the jacketing of steel during the past few months owing to the danger of damage to concrete by frost.

Construction of roundhouses and shops is well under way. The machine and blacksmith shop, 80 ft. x 145 ft., is all finished, except for applying the composition roofing, installing window sash and doors and putting down floor. One 25-stall locomotive roundhouse is completed except for a few engine pits, about half the roof, the brick cornice and putting in doors, windows and floor. The car repair shop is ready except for roof finish, doors, windows and

floor. The steel work for the coal wharf and sand house is on the site and some foundations have been laid. The foundations of the oil house have been begun. The engine turntable pits have been finished except for putting in brick floor and setting wood curb on circle. The tables are both on the ground. The First street tunnel has been finished except for a small amount of track work and is ready for use. The putting in of special frogs and switches under the plaza is finished and ready for use.

To sum up, about 75 per cent. of all work on the station building has been finished, the proportion completed covering work which takes a long time, the remaining work that which can be done with speed. The filling of the plaza and the streets leading to it is about 80 per cent. completed, the remaining work being the filling of the space now occupied by the passenger tracks of the Baltimore & Ohio. This will be undertaken as soon as the B. & O. begins running trains into the new station, which will be during the present year. The filling of the north approach and train yard is about 95 per cent. finished, there being a little work still to be done east of the power house. The masonry construction on this part of the



Main Power House, February 22, 1907. 275-ft. Stack Finished. Structural Steel Nearly All Erected and Riveted. Stone and Brick Work Just Started.

work is done. About half the track work on this section has been finished, including most of the special frog and switch work in the throat of the train yard. The grading for the coach yard, including roadbeds for the Washington and Metropolitan branches of the Baltimore & Ohio and the Magruder branch of the Philadelphia, Baltimore & Washington, is 90 per cent. finished, and about half of the tracks have been laid. Grading in the shop yard is finished and about half of the work on roundhouses and shops completed. Some 70 per cent. of the tracks in this locality are laid and ballasted.

Both Hamburg and Berlin trade representatives have asked the Prussian railroad authorities to arrange for the transportation of milk to the great cities in tank cars. The Hamburg people say that transportation in cans limits the field of supply to dairies within 100 kilometers (62 miles), which certainly is not the case in this country. But the rates on milk have more to do with it than the receptacles in which it is carried. Milk was brought from Denmark in tank cars for a little while a few years ago, but this was found to be illegal.

Track Deformations and Their Prevention.*†

BY G. CUENOT.

Government Engineer of Bridges and Highways, and connected with the Board of Control of the Paris, Lyons & Mediterranean Railway.

IV.

DETERMINATION OF THE LENGTH TO GIVE TO CROSS TIES AND TO THE TAMPED BED.

After proving that the most advisable length for a tie for diminishing its flexure ought to be in the neighborhood of 7 ft. 2.64 in. I desired to determine the latter experimentally with wood ties of different lengths, tamped unequally, and placed on a level and on straight line, in order to avoid all chance of error.

SIDE TRACK AT BOURG-EN-BRESSE.

Mr. Ferry, Sub-Engineer of the P. L. M. Co., wished expressly to aid me with his counsels, and to build an experimental side track. This track, placed at the extremity of the cul-de-sac of the track for unloading animals at the station of Bourg, P. V., was isolated from the switching of that station, so that we could easily proceed with all the trials without being obliged to abandon them and then resume them, which causes the loss of much time and interrupts their course.

The ties on trial, wood, steel and composite, were always placed at the same point, about 6.56 ft. from the neighboring ties; the rail was raised up on it $\frac{3}{4}$ in. above them; thus the axle load, 13.22 net tons, rested entirely on the experimental piece. In order to avoid raising of the track at the extremity of the cul-de-sac, the extremity of the rails was loaded and held in place. A tent was set over the working place to completely shelter the track and withdraw it from atmospheric influences; in this manner, the ballast, formed of fine gravel, and the subsoil, were always found in the same hygrometric conditions. A tie was placed at the predetermined site, and at the aforesaid height, with reference to the neighboring cross ties; for there were buried in the roadbed in excavation, on both sides of the track, two strong stakes 4.92 ft. deep, and between them a rigid string was extended, in order to determine the position of the axis of the piece and the height of the rail.

The parts marking the surface of the tie in a free state were measured by means of the rule described, as has been explained in the preceding tests. Two readings were taken by means of the wedge gage provided with a runner, in order to be able to estimate the hundredths of a millimeter. The wood ties were provided, as before, with screws with square heads, invariably fixing the points of measurement; but in order to assure the horizontality of the wedge, there was placed in front of the first screws other similar screws provided with a notch for guiding it.

The vehicle, loaded with care with pieces of rails, weighing 26.46 net tons, was mounted on two axles; when the first reading was finished, it was brought close to the cross tie, at a point of the rail determined by the position of the wooden wedges. It was allowed to stand for an hour, and two readings were made on each point, as in the other tests. Each reading was controlled with care and checked by other experimenters when the difference attained two hundredths of a millimeter. The mean of the figures was taken, which approached consequently nearly to one hundredth of a millimeter. The vehicle was removed, the beam recovered, and the new position of its axis was ascertained by two new readings. The difference between the figures of the original position without load and of the position with load, gave the total sinking; the difference between the latter situation and the new position of the piece without load, determined the elastic sinking. The permanent sinking resulted from the difference between these figures. In Nos. 1 to 12 of Fig. 12, which displays these experiments, the full lines represent the position of the original axis and of the deformed axis; the dotted line, the axis after recovery of the beam.

The experiments were made with wood ties of different lengths with variable tamped beds, and with the composite tie and the steel tie of the state.

Wood tie 8 ft. 6.36 in. by 8.66 in. (Nos. 1 and 2, Fig. 12.)—We commenced with an oak cross tie well squared, 8.66 in. wide, 5.51 in. thick and 8 ft. 6.36 in. long. The tamping extended over its whole length. The beam was deformed under the load according to the curves in Nos. 1 and 2 of Fig. 12. Their form is convex, raised towards the center, with a tendency to uplift at the extremities, the pressure being less strong at those points. The sinking is more pronounced on the left side, .16 in. by .18 in., than on the right side, .154 in. by .173 in., by reason of the greater solidity of the subgrade. At the center it is only .10 in. and .12 in. The elastic upraising is greater in the first test than in the second, without doubt because the tamping had been more compact; it attains, in fact, .91 in. in the first case and .06 in. second. The

greatest compression is found on the exterior side of the rail (first test .185 in., second test .18 in.), which is explained by the reaction of the ballast, which rights the cross tie and inclines it towards the extremities.

Tie 8 ft. 6.36 in. by 8.66 in., tamped at the end at 15.75 in. each side of the rail. (No. 3, Fig. 12.)—The same tie, tamped at its extremities and at 15.75 in. on each side in the interior, served for this test. The tamping was limited by two angles fixed to the bottom of the tie at the extreme points of the tamping. The form attained is that of the basin observed at St. Etienne-du-Bois; the bottom is slightly raised in comparison with the left side; the extremity of the right, resting on a more solid foundation, is raised more. The compression is maximum in the interior of the track; the sinking attains .185 in. to the left and .18 in. to the right. The elastic uplift has taken place according to a slightly concave curve, like that which is generally observed at the working places of cross tie renewals. It is sensibly equal to that stated above, about .063 in., the mean permanent sinking being .106 in.

Tie 7 ft. 6.96 in. long, tamped over 15.75 in. on each side of the rail. (No. 4, Fig. 12.)—The same tie reduced to 7 ft. 6.96 in. and tamped over 15.75 in. on each side of the rail was the object of a test. The tamping was limited as above by angles. The curve took the form of a basin more flattened than the preceding, with raising in the central part, the pressure tending to be distributed equally over the ballast. The total sinking is less in consequence of this fact; it scarcely reaches .150 in. while it exceeds .18 in. in the preceding case. The elastic uplift is consequently a little less. The maximum pressure is exercised in the interior and near the rail.

Tie 7 ft. 6.96 in. long, with tamped bed 15.75 in. and 21.65 in. (No. 5, Fig. 12.)—This tie, 7 ft. 6.96 in. long, was unsymmetrically tamped 15.75 in. at the extremities and 21.65 in. in the interior. The total sinking is not greater than in the preceding case; the pressure is distributed; the center is raised up, being little more than with the symmetrical tamping, which depends on the fact that it is naturally more supported. The elastic uplift is made as above; the beam is righted so to speak parallel with itself.

Wood ties 7 ft. 3 in. long, with tamping 13.78 in. on each side of the rail. (No. 6, Fig. 12.)—The same tie, reduced to 7 ft. 3 in. long, was tested with two different repetitions with a symmetrical tamping 13.78 in. long on each side of the rail. The curvature of the elastic line diminishes (No. 6, Fig. 12); the beam is lowered, so to speak, parallel with itself. The pressure is equally distributed over the ballast. The total sinking seems greater, which holds with tamping which has been more or less condensed; but the elastic uplift, which is only to be considered, is nearly the same, to some tenths of a millimeter.

Wood tie 7 ft. 0.6 in., with unsymmetrical tamping. (No. 9, Fig. 12.)—The unsymmetrical tamping of this same tie, which is 7 ft. 0.6 in. long, because it was effected over 12.6 in. at its extremities and over 14.96 in. towards the interior, raises the preceding curve toward the center, a curve which is convex at the middle and inclined towards the extremities.

The pressure is exercised more towards the exterior, for the reason that the beam is sustained on the side of its center; it is distributed, however, better than in the first cases examined; the total sinking is always nearly the same as the elastic uplift. The latter preserves the same value approached after a second test. The beam returns parallel with itself.

Wood tie 6 ft. 11.04 in., with unsymmetrical tamping. (No. 8, Fig. 12.)—This tie was 6 ft. 11.04 in. long, with an unsymmetrical tamped bed of 11.81 in. at the extremities, and of 15.75 in. towards the center. It takes a convex form under the load, as in the preceding test. The maximum sinking, very pronounced towards the extremities, is more important because the latter have been brought more closely to the point of application of the pressure. The elastic uplift is the same, and is made nearly parallel to the axis of the deformed beam. After three successive tests, the second after two hours, the third after four hours, the lowering has scarcely increased; the beam is always deformed parallel with itself and the elastic uplift remained what it was after the first test.

COMPOSITE TIE.

(No. 10, Fig. 12.)

The composite tie behaved as in all the earlier experiments; it was lowered nearly parallel with itself without apparent deformation. It reascended the same. The total sinking is nearly the same as for the wood ties; the elastic uplift is also the same. The beam is righted according to a plane slightly inclined on the side where the earth was the more solid.

METALLIC TIE, STATE STANDARD.

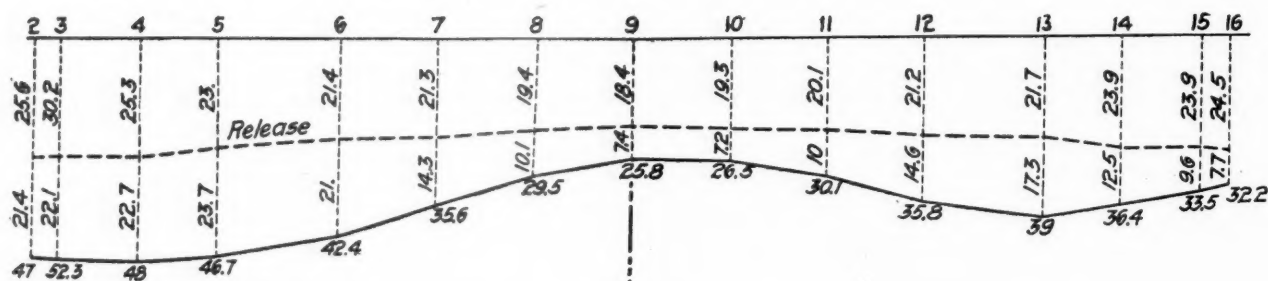
(Nos. 11 and 12, Fig. 12.)

The metallic tie of the state system was tested with two tamped beds, the first over its entire length, the second over its breech, and 15.75 in. long in the interior of the track.

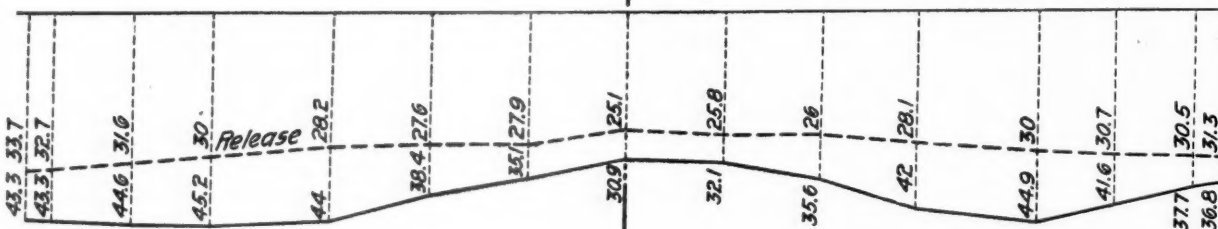
In the first case the deformation has occurred in a very irregular fashion, following a convex form in the center with the ordi-

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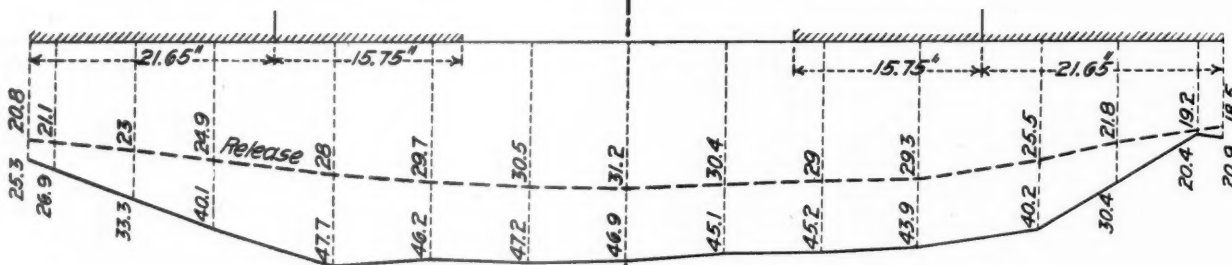
†Authorized translation by W. C. Cushing, M.A., B.S., Chief Engineer of Maintenance of Way, Pennsylvania Lines West, Southwest System.



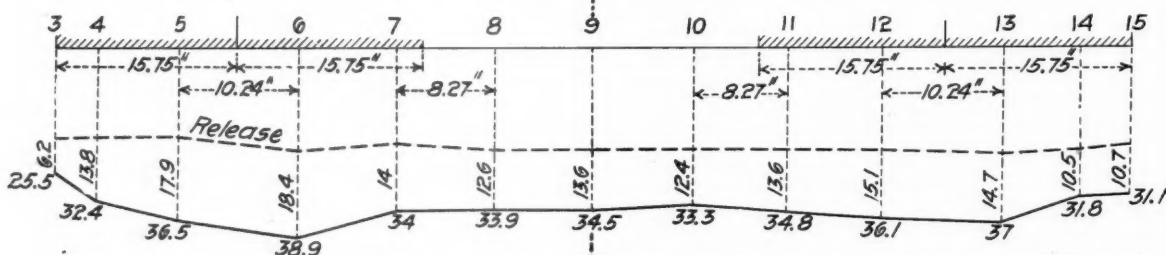
No. 1—Wood Cross Tie of 8.53 ft. x 8.66 in. Tamped for its entire length.



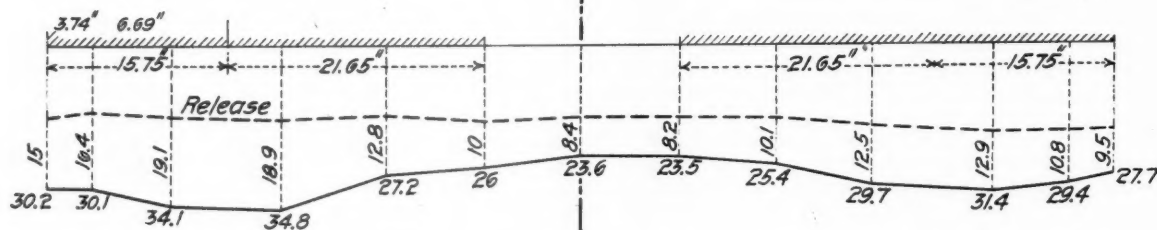
No. 2—Wood Cross Tie of 8.53 ft. x 8.66 in. Tamped for its entire length.



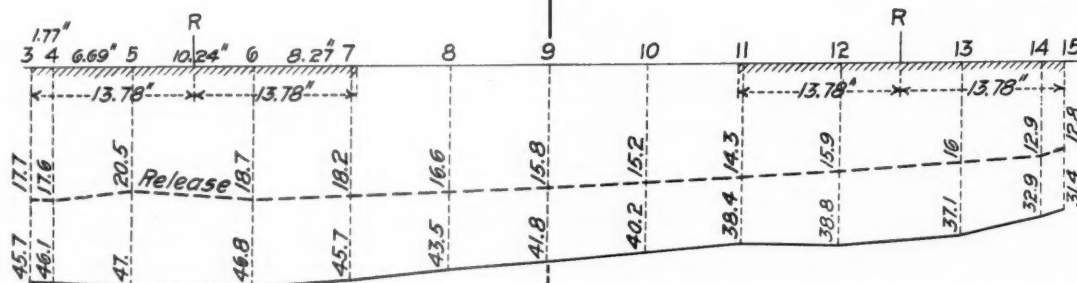
No. 3—Wood Cross Tie of 8.53 ft. x 8.66 in. Tamped at end and for 15.75 in. on each side in the interior.



No. 4—Wood Cross Tie of 7.58 ft. length Tamped for 15.75 in. on each side of the Rail.

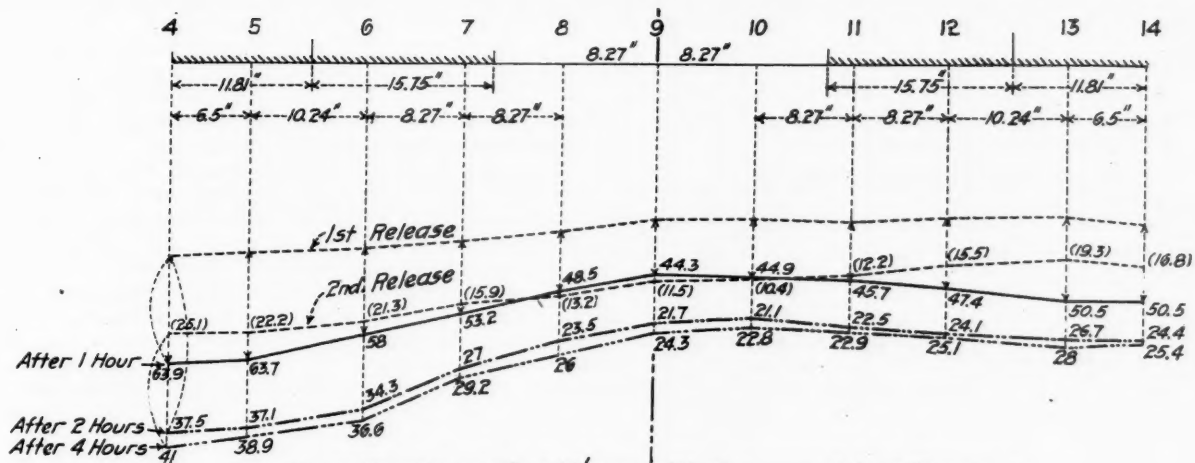


No. 5—Wood Cross Tie 7.58 ft. long Tamped for 15.75 in. and 21.65 in.

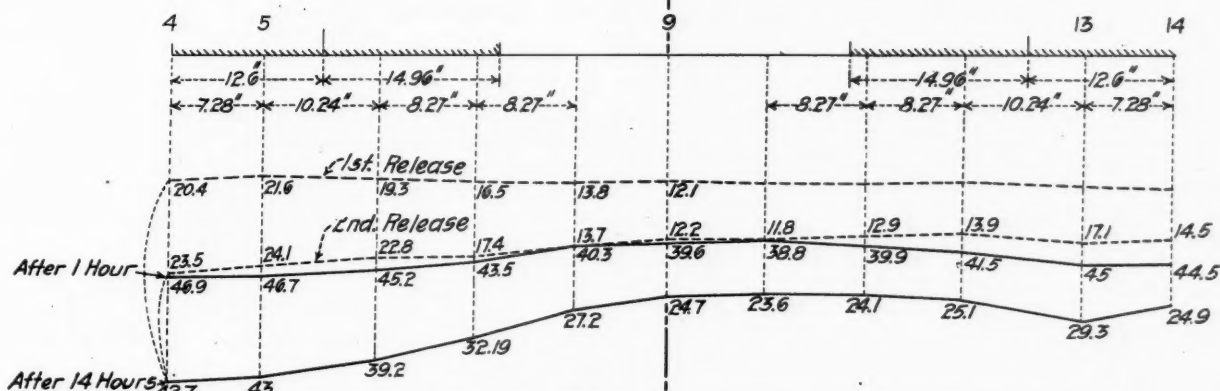


No. 6—Wood Cross Tie 7.25 ft. long Tamped for 13.78 in. on each side of the Rail.

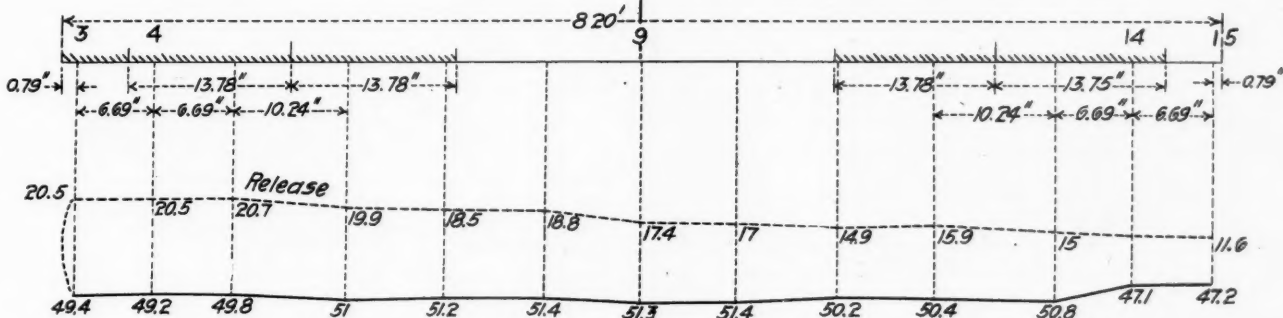
Fig. 12.



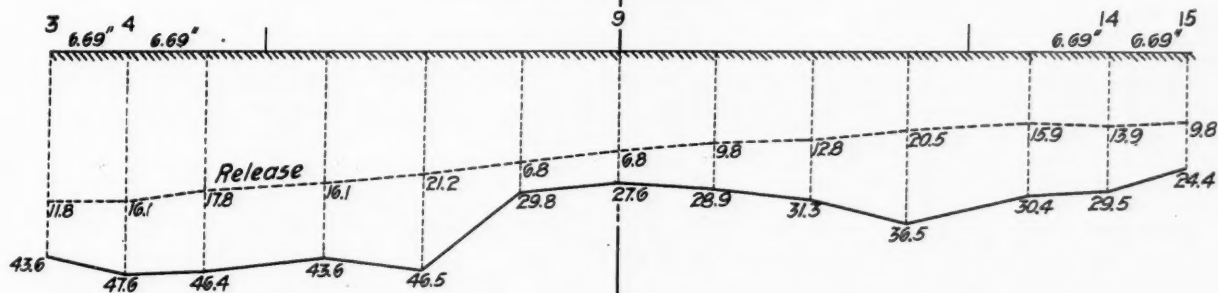
No. 8- Wood Cross Tie 6.92' long with Unsymmetrical Tamping.



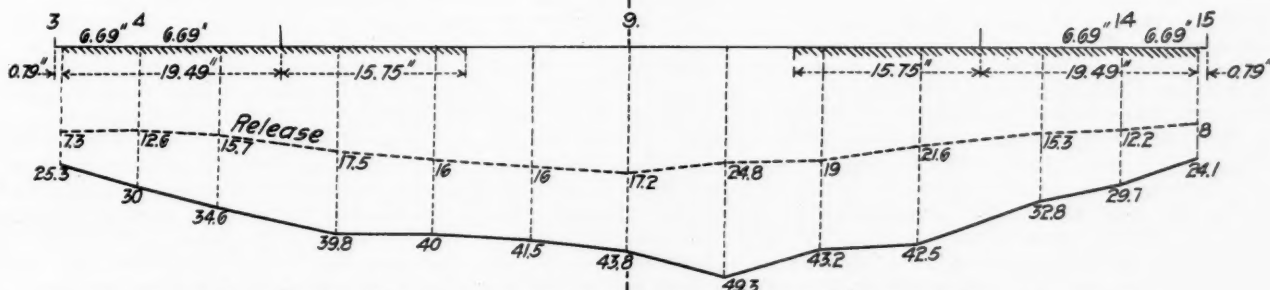
No. 9- Wood Cross Tie 7.05' long with Unsymmetrical Tamping.



No. 10- Composite Cross Tie.



No. 11- "State" Metallic Cross Tie Tamped for its entire length.



No. 12- "State" Metallic Cross Tie Tamped at the Ends and 15.75" in the Interior.

nary sinking; the beam is uplifted according to a plane inclined to the left. It seems, at first sight, to have no very regular resistance in all its sections, and to be bound to be deformed quite rapidly.

In the second case, the curve is more regular and is concave towards the center. The beam is righted according to the profile of a catenary, which ought to give it in time a permanent deformation and produce a diminution of the track gage.

SUMMARY OF EXPERIMENTS.

In all the experiments which have just been related, the relative sinking of the ties with each other has not been sought for, since that question was solved on the main track from Bourg to Saint-Amour, and since the necessity for a tamped bed, executed in a more or less firm manner, in one test or the other, and, as a consequence, irregularly settled, render all comparison illusory.

But the following points should be retained from the study which has been made:

(a) The long ties, 8 ft. 6.36 in. to 7 ft. 6.6 in., take, under the load, the form of a basin, with the bottom slightly raised in the center.

(b) The short ties, 7 ft. 0.6 in. to 6.5 ft., are deformed according to a curve, convex or otherwise, and inclined toward the extremity.

(c) The ties between 7 ft. 0.6 in and 7 ft. 2.64 in. are lowered parallel with themselves without sensible curvature.

(d) The unsymmetrical tamping raises the curve towards the center; a very feeble lack of symmetry reacts very clearly in this direction.

(e) It is possible, then, by increasing the rigidity of a cross tie, notably by concentrating the material about the supports, to reduce its sinking to the quantity which is intended as a limit, and its flexure in such measure as one would wish.

(f) The permanent sinking of the ballast is variable according to the case, but the elastic sinking, the only one there is reason to consider, is, so to speak, constant, whatever be the length and type of the cross tie adopted. The deformation is slowly produced and augments with time.

DYNAMIC EXPERIMENTS.

Main track No. 2, from Mouchard to Bourg.

The results obtained under moving loads, at the passage of several trains traveling with different speeds, have always been the same, comparatively, as those obtained in the static state. They are always less, from 10 to 20 per cent., than the latter, and the difference observed between the flexure of the wood ties and of the composite ties supporting the same rails is maintained, the latter being less deformed, and sinking less than the former. The reference marks were at first placed at 5.12 in. on the interior of the two rails, points where the maximum deformation in the static state is produced, then on five points equally distributed over the length of the pieces. The figures have always been found less than those of the static state (the mean .05 in. for ties of wood, .035 in. for composite ties); the composite tie descended parallel with itself, while the wood tie is deformed according to the curves described above.

All the experiments which we have made, as well as those which have been previously realized by Mr. Ferry, lead to the same conclusion; dynamic actions produce less effect than static actions; in order to obtain the maximum deformation, it is then sufficient to examine what occurs in the static state.

The apparatus for measurement, which is very simple, and disposed in such a manner as not to be influenced in the course of the trial, cannot be considered faulty. The rod which sustains the spring is buried to 4.92 ft. in the soil; it should be able to rise up vigorously under the load, which would increase the bending figures, but it cannot descend under that influence. As to the spring, it will not grip against the glass plate, but it will slide against it. Besides, Mr. Ferry has shown that the figures of deformation were the same in the static state, whether they be observed by means of the rule or by means of the spring register. The results obtained under a moving load ought, then, to be considered as exact.

It is necessary, then, that the dynamic actions be exercised with less intensity than the static actions. There is, we believe, a law which ought to be nearly general, except in certain particular cases. The deformation of the material is made slowly, and as much more slowly as the latter is more rigid, and as the mechanical actions take place in a short time. A spring registers slowly the forces to which it is submitted; at the same time, preserved from their effect, it is distended no less slowly, and retakes its primitive form in a time of definite duration. One can walk without leaving an imprint on a moving soil of weak consistency, when walking rapidly; the deformation has not had time to be produced. If, on the contrary, one stood still on the same soil, the latter would be deformed more or less rapidly, according to its degree of resistance.

All the known facts confirm this law of deformation, which can be considered as general. Without doubt, it is admitted that in metallic work, dynamic actions increase static actions by 70 per cent.; but that does not weaken in any way the law which we have derived from these experiments.

The tie on which the flexure has been studied does not take the proper deformation which it should have under the action of loads, but it undergoes that of the ballast, which serves for its support, and of the bed of the ballast. It results that its deformation is limited by that of the material which sustains it. This material acts on the tie after the manner of a powerful spring, which slowly registers the forces which it receives, and which does not attain to registering them completely when they arrive in too short a time. In particular, the shocks which are the consequence of dynamic actions, and which are only susceptible of increasing the flexures in the static state, cannot produce this effect, because they act in too short a time for influencing the spring.

It is not the same as a piece of metallic work, which, not being sustained, obeys all the vibrations it receives, and which are so much the more intense as they are due to a more violent and shorter shock. Such is the chord of an instrument, which, taut, enters into vibration under an instantaneous influence, for example, the sound rendered by a neighboring instrument. Shocks have thus an important action on a metallic floor, which registers them by reason of its situation and their instantaneousness; but they have not any on a piece sustained by an elastic material but reacting by its mass after the fashion of a spring. It is possible that the materials of the track, the rails, for example, do not obey this last law, but the experiments made up to this time permit of no conclusion either in one direction or the other.

LATERAL MOVEMENT.

Apart from the transverse movement, which we have just been studying, the track is submitted to a lateral movement, which is explained as a sliding movement, and often causes derailments. Weber has determined the maximum values of the sliding movement of the track which are produced in the course of normal traffic. His tests have demonstrated that in alignment it produces displacement which may reach $\frac{1}{8}$ in. for the base of the rail, and .28 in. for the head.

Engesser has proved that it would suffice for main tracks, to take 0.15 to 0.25 G (G load on wheel) as the ordinary value of the horizontal force.

But if the greatest vertical pressures on the track are produced by the overloaded axles, the greatest horizontal pressures are due to the unloaded axles. The latter have their greatest effect when the ballast is the most unsettled, that is to say, when it has just been changed or renewed.

It was then placed under the most unfavorable conditions; the experimental ties were arranged as follows: Wood ties and steel ties in a switching track at the Bourg station. They were isolated from the neighboring ties, either by super-elevating them and removing the plates from the neighboring pieces, or again by withdrawing the latter from the track (Nos. 1 and 2, Fig. 13); in this manner it was certain that the cross tie under experiment alone sustained the weights which were placed on it. Besides, the shoulder plate of the cross tie under experiment was replaced by an ordinary flat plate, and the screw spikes were withdrawn so that the cross tie could slide under the rail, but in order to diminish the friction, the surfaces in contact were greased.

This done, the tie was pushed, being thus rendered independent, and without load, by means of the Collet déclinmètre, installed, on the one hand, against the extremity of the piece, and on the other hand against a very solid wall. Then the same tie was loaded by means of an axle of 6.61 net tons, and the experiment pushed in the two cases up to the moment when a displacement of .8 in. was obtained, at which the track can be considered as out of service.

The results of these experiments are given in the table below:

	For a displacement of .8 in.	
	Without load.	With load.
Composite tie, in the free state.....	From 4,189 to 5,291 lbs.	15,212 lbs.
Wood tie, in the free state.....	220 lbs.	11,684 "
Steel tie, in the free state.....	1,102 "	7,496 "

The composite tie offers a resistance 24 times greater than that of the wood tie when it is not loaded, that is to say, when this resistance presents its weakest value. When it is loaded with an axle of six metric tons, its resistance to sliding is still greater by nearly 3,307 lbs. than that of the wood tie. This is not true of the steel tie; the latter, at first more resistant than the wood tie, not carrying any load, becomes less under the load, which appears to arise from the less friction of the ballast against the metallic body.

If only the two ties, respectively the wood and the composite one, are considered, it is observed that their resistance to sliding being respectively about 220 lbs. and 4,409 lbs. without load, there remains for the resistance under the load of 6.61 net tons, 11,464 lbs. for the first and 10,802 lbs. for the second. The friction which operates against the sliding is thus proportional to the weights and not to the frictional surface or the substances having the same adherence with the ballast. Mr. Ferry has found that for wood ties this resistance varies from 50 to 80 per cent. of the overload, 50 per cent. when the pieces are smooth, freshly creosoted, 80 per cent. on the contrary when they are rough, and when the superficial layer of creosoting has been cut by the rubbing against the ballast. He has equally demonstrated that the addition of angles

under the cross tie, in a word of projections able to give support against the ballast, sensibly increased the resistance to sliding by about 20 per cent. of the overload.

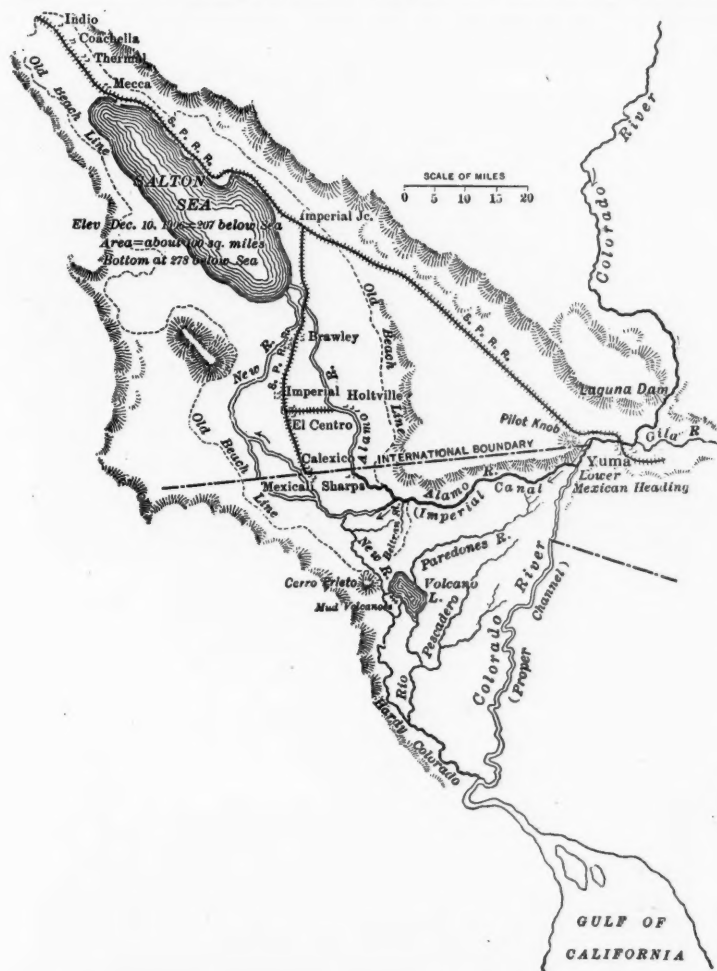
In the particular case, the wood ties being experimented with, having been placed for a long time in the track, ought to offer a maximum adherence; the coefficient reached 80 per cent. of the overload, that is to say, about 10,582 lbs., nearly the figure given above, 11,464 lbs. For the composite tie placed in the track at the same moment of the experiment, the adherence was not great, scarcely 60 per cent.; it was then 7,937 lbs., to which it was necessary to add the 20 per cent. due to the cross bars, 2,646 lbs. The total resistance would thus be, theoretically, from 10,582 lbs. to 220 lbs., near the figure obtained. The observations of Mr. Ferry are then completely confirmed.

Again, it ought to be remarked that the thickness of the cross bar or of the roughness ought to be relatively small, to have its full efficiency. A centimeter of protuberance suffices and it is easily conceived, for the tamped bed has no compactness, and only offers consequently resistance in its upper part. The maximum useful effect is thus produced on the surface of the ballast; an increase in the relief of the cross bars does not produce an increase in the resistance. That results from experiments made by the P. L. M. Co., and explains the results which have been found with a tie provided with cross bars.

(To be continued.)

The Lower Colorado River and the Salton Basin.*

Early in 1905 it became apparent that the Colorado river would change its low-water course; that it would thereafter send its low-water flow and a part of its flood volume inland into the Salton Basin instead of oceanward into the gulf of California. The point



Lower Colorado River and Salton Basin, October 1, 1906.

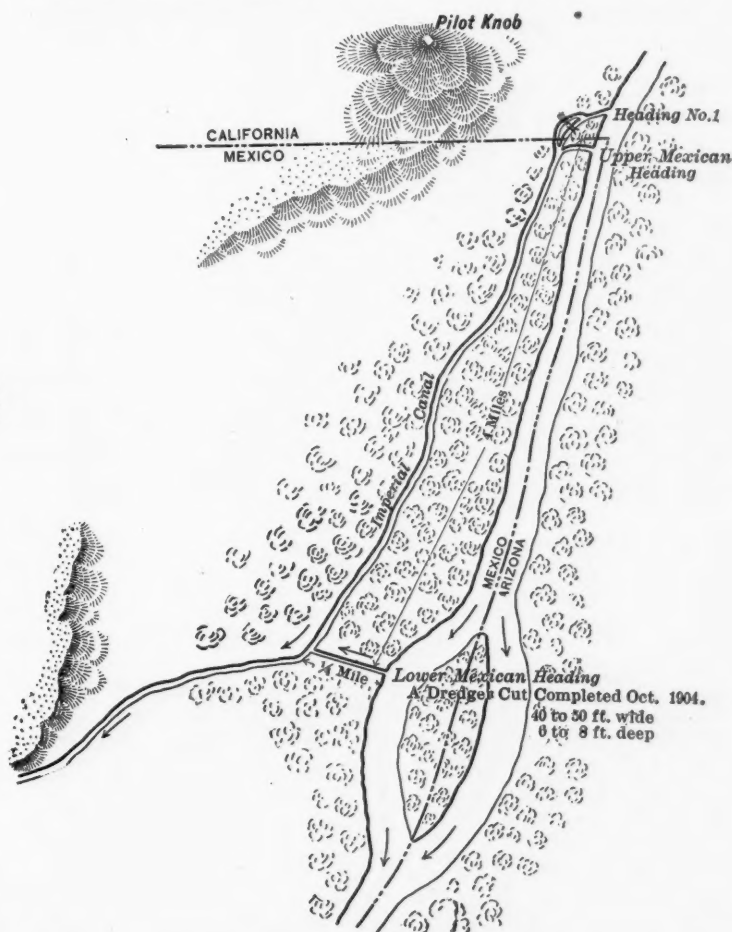
in Mexico where the canal company (the California Development Co.) made the diversion which threatens to become the permanent river channel is about four miles south of the boundary line between California and Mexico. In the spring and summer of 1905, the Colorado river—in lower California at this point, which is some 12 miles below Yuma—enlarged a small artificial channel or cut which connected the river with the Imperial canal, and also enlarged the canal to such an extent that this so-called canal heading and the canal became the river's low-water channel. The river, in November, 1905, during a flood stage, made this heading and por-

tions of Alamo and New rivers and certain sections of the canal its main channel. The river thereupon flowed inland for a year, discharging into the Salton sea instead of holding to its original southerly course with discharge into the gulf of California, where it belongs, and where its waters have gone for centuries. The river was turned from this inland course on November 4, 1906, but could be held in its proper channel only until December 7th, when the protection works gave way. The river is again flowing into the Salton sea. The Salton sea is the water of the Colorado river which has accumulated in California in the bottom of the depression known to geographers as the Colorado Desert.

The canal, which for the present has become a river, was built for irrigation of lands in California in the Imperial Valley, as the southern portion of the Salton Basin is called. The original water diversion from the Colorado river, by the California Development Co. was made in the southeastern corner of California within a few hundred feet of the international boundary; but the operations which led to a change of the river's course were entirely in Mexico, and are presumed to have been conducted under concessions granted by that country.

A continuation of the inland flow of the Colorado river would in time bring disaster to the Imperial valley. It would further damage the property of the Southern Pacific, which has already sustained great financial loss, and would ultimately ruin all improved lands in the Salton Basin as well as the lands along the lower sections of the Colorado river. It would modify or destroy the irrigation possibilities along this river below its canyon.

"Salton Basin" is the name applied to the region in southeastern California and northern Lower California which will ultimately be submerged if the Colorado river continues to discharge inland instead of into the gulf of California. This region extends northward to a point a few miles beyond Indio, and toward the south overlaps the international boundary some 15 to 20 miles. The



Colorado River and Imperial Canal Headings in Spring of 1905.

length of the basin which is thus threatened with submersion is about 100 miles from north to south; its surface area is about 1,950 square miles, and its mean width nearly 20 miles. The lowest point of this basin, at the former salt beds, now more than 70 ft. under water, is 278 ft. below sea level. The rainfall in the country adjoining this great depression is so slight—only a few inches a year—that practically no run-off reaches its lowest points. All the water now there, covering more than 400 square miles, is inflow from the Colorado river.

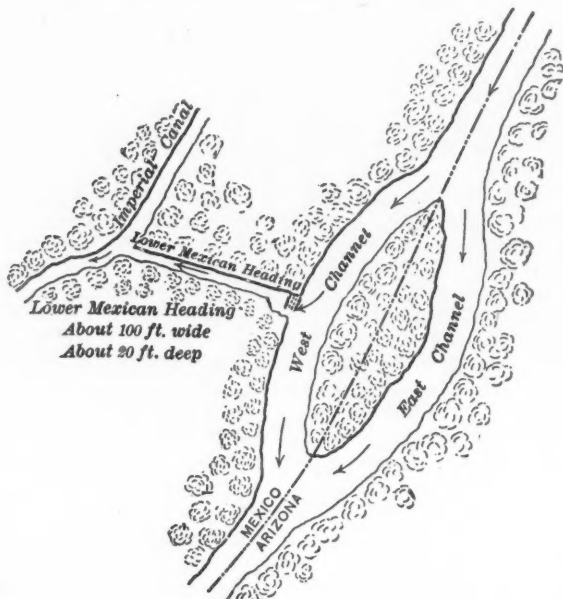
The Southern Pacific about 1876 built its main line across this depressed area, dropping to a lowest point near Salton, about 265 ft. below sea level. Its main line, from a point several miles north from Indio to near Flowing Well, some three miles east

*Presented by C. E. Grunsky, M. Am. Soc. C. E., March 20, 1907, before the American Society of Civil Engineers, and published in the *Proceedings* for February, 1907, page 102, Vol. XXXIII, No. 2.

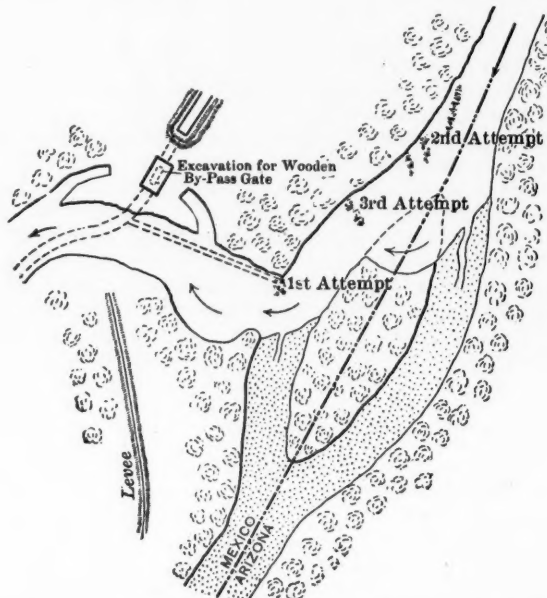
from Imperial Junction (formerly Old Beach), is below sea level. In January, 1905, the population of Imperial Valley was 10,000. Calexico is at sea level, Imperial about 60 to 70 ft. below sea level, and Brawley about 110 ft. below sea level. The surface of Salton sea is now about 207 ft. below sea level. The rise of the water, therefore, would have to be about 90 ft. before the country near Brawley would be inundated.

The canal system was not planned for such unforeseen flood

per mile to a point near Calexico. Thence northward into Salton Basin, on lines of greatest slope, the country falls away at the rate of from 4 to 5 ft. per mile. These gradients, which are cross-country gradients and do not show the fall of the water surface following the meanderings of the several watercourses, make it plain that the river while flowing inland must cut deep into any yielding material. Its proper fall was about 120 ft. in its course from Yuma to the gulf, 80 miles distant, whereas it now falls some 325 ft. to



Colorado River at Lower Mexican Heading of Imperial Canal, June 23, 1905.



Colorado River at Lower Mexican Heading of Imperial Canal, March 19, 1906.

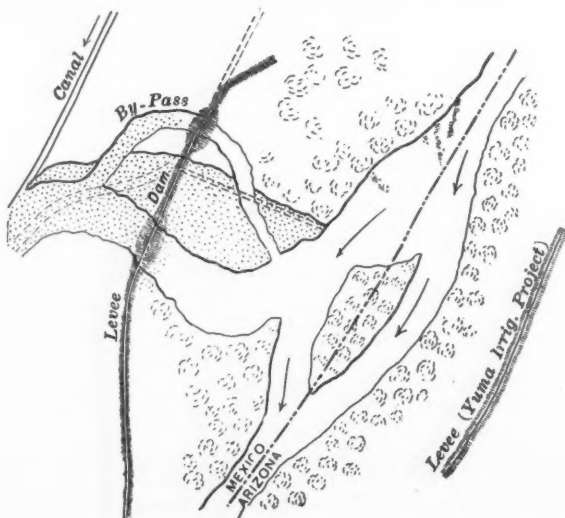
conditions. Structures were inadequate to safeguard properly the supply to the canals. Constant vigilance was required to keep out the undesirable flood, and to keep, in the canals, an adequate supply for the needs of the irrigators. In fact, many critical periods have been passed. Any untoward accident at Sharp's Heading during the flood stage of the river would have made the entire Imperial country untenable. An accident there, such as a wash-out of the waste-gate, which drops water some 20 ft., would have deprived the canal system of water—a serious situation for a region in which even the water for domestic use is supplied by the canals.

The topographic features of the country make it plain why all this has happened. The river, like all turbid streams, is still building up the alluvial country through which it flows. It drops some of its silt wherever it sends its water. At flood stages, when there is overbank flow, the rate of silt deposit is most rapid near the river. The frequent inundation of the bank lands adds to their

the Salton sea which, in the general direction of the water's flow, is only from five to ten miles farther removed from Yuma. The excess of energy represented in these figures has been largely expended by the river in deepening and enlarging its new bed.

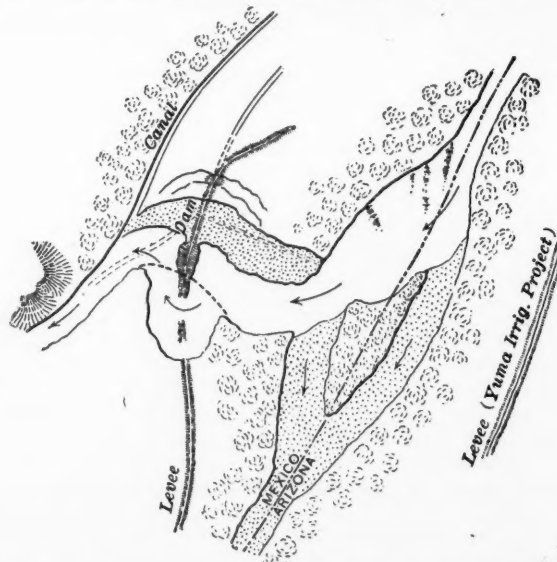
The canal of the California Development Co., as originally built in 1899, had its head in California about 100 yds. north from the international boundary. Silt accumulations in the head of the canal interfered with its successful operation, and water shortage resulted in the Imperial valley in the fall of 1903, and continued throughout 1904. On application to the Mexican government a concession was granted which made it possible to construct the works which in operation have proven so disastrous. The original canal was carried from California into Mexico, and paralleled the river for a distance of about $4\frac{1}{2}$ miles, being at no point much more than one-quarter mile from the river bank.

There was built just south of the international boundary a



Lower Colorado River, Showing Location of Dam Which Turned the River Into Its Proper Channel, November 4, 1906.

elevation more than is added to land farther away. Therefore, here, as should be expected, the land slopes away from the river. The Colorado river flows southerly in a direction in which the general fall of the ground surface is only about $1\frac{1}{2}$ ft. per mile, which the river in its meanderings cuts down to an effective fall of about 1 ft. per mile. Toward Volcano lake, southwest from the river, the general surface gradient is 2 ft. or more per mile; and westward, in the direction paralleling Alamo river, it is nearly 3 ft.



Lower Colorado River, Showing Condition on December 12, 1906. Break in Levee Came at 3 A. M., December 7th.

cut less than 100 yds. long from river to canal, also a second similar connection about four miles south of the boundary line. Neither of these connections between river and canal, commonly referred to as the Upper and Lower Mexican headings, was provided with regulating gates. Both were simple dredger cuts of moderate depth and width. The Upper Mexican heading, like the original canal head in California, showed a pronounced tendency to silt up. The Lower Mexican heading, on the contrary, which came into use as



Alamo River at Holtville Railroad Bridge, August 1, 1906.



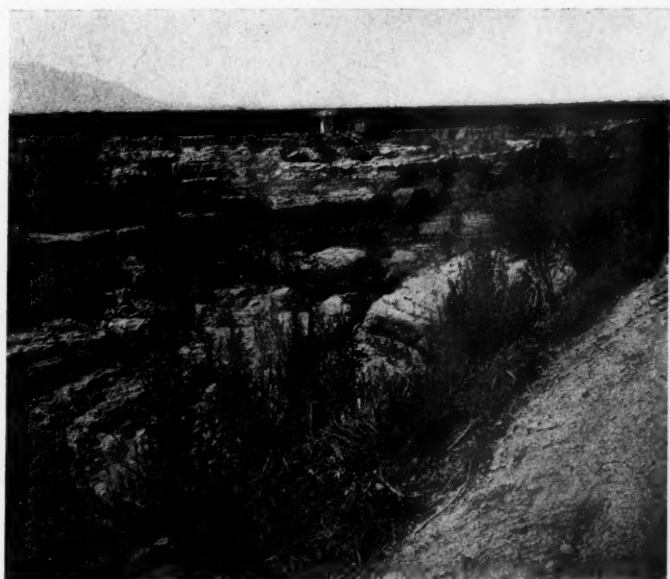
By-Pass at Lower Mexican Heading of Imperial Canal, August 26, 1906.



The Barranca of New River at Mexicali, September 1, 1906.



The Barranca of New River Five Miles Northwest of Imperial, August 31, 1906.



Ruined Field Near New River, About Four Miles Northwest of Calexico, September 2, 1906.



Sunset Across Salton Sea. From New Salton Railroad Station, August 29, 1906.

a channel from 40 to 50 ft. wide and from 6 to 8 ft. deep, had sufficient fall from river to canal (reported at upwards of 1.5 ft. in about 1,300) to give the water a scouring velocity. The bed of this heading was enlarged by the flow through it, but this, at first, caused no alarm. Large canal capacity was desirable, and natural erosion of the channel would reduce the ultimate cost of construction; but soon a time came when the progress of this channel enlargement was too rapid, and measures had to be taken to shut off the flow at the intake. The canal company being in financial difficulties in June, 1905, direction of the work of checking the excessive flow was assumed by the railroad officials. The situation in parts of the Salton Basin had in the meantime become serious. The rising waters were at the base of the railroad embankment (end of June, 1905), and it was only a question of a few days before the roadbed for many miles must be abandoned. Quick action, and an early check of the inflow of water would save the railroad great expense. Strenuous effort to accomplish this result, therefore, was justified, and led the railroad company to extend financial aid to the canal company.

All the time (summer, 1905), even while the river was falling, the volume of water presented for passage into the Salton sea kept increasing. The lower heading, in the latter part of June, had been widened to 100 ft. or more, with a depth of about 20 ft. It was then discharging about 7,000 to 8,000 cu. ft. per sec., and it was but a short time before this flow was doubled. It became evident early in July that, if not checked, the river would make the Lower Mexican heading its low-water channel. Not only did the river do this, but it increased the canal capacity to such a degree that the canal during the flood stage of November and December, 1905, became the main channel of the river.

In the fall of 1905, after several failures, an attempt was again made to force the entire river into a channel east of an island in the Colorado river opposite the Lower Mexican heading. This island was narrow, and about a mile long. The point at which the attempt was made was about 1,000 ft. below the head of the island. Here the construction of a dam with a broad brush mattress foundation was undertaken. Mats of brush 100 ft. wide in the direction of the stream, were placed from bank to bank across the western channel of the river. Piles were driven in three rows through these mats, which were about 18 in. thick, and more brush was woven between these piles. This work is reported to have been making fair progress, notwithstanding a stage of the river considerably higher than the ordinary stage for that time of year, when the unexpected happened. A flood occurred on the Salt and the Gila rivers, and a tremendous volume of water was suddenly discharged into the Colorado river at Yuma. In a few days the river rose from a low stage to become a raging torrent with a maximum discharge, on November 30th, of more than 100,000 cu. ft. per second. This water overtopped the island. It cut around the eastern end of the incomplete dam and tore away the head of the island. It quickly cut the heading to a width of several hundred feet and gave it all the appearance of a permanent section of the main river.

Throughout 1906 the river has been continually at higher stage than normal; the monthly discharge for each month is nearly if not quite equal to the maximum monthly totals ever recorded, and the aggregate discharge has been more than twice as great as the river's normal annual flow. Preparations were made for a supreme effort to stop the flow at the lower heading during the expected moderate and low stages of the river in the late fall of 1906.

A spur track about six miles long was built in August from near El Rio to the Lower Mexican heading. A large force of men was assembled, and all the facilities at the disposal of the railroad were called into requisition. The importance of rapid work was thoroughly appreciated. Brush mattresses were placed successfully across the 600-ft. opening in which the river was to be held, and in which its waters were to be gradually raised by obstructing its flow with brushwork and rock. Two trestles were built across the stream, facilitating the rapid delivery of material. This work was making favorable progress, and a fair proportion of the river's flow—still far above normal—was already passing through the timber gate when, on October 11th, this gate suddenly gave way. It broke in two and its northerly half floated away. Although the situation looked hopeless, there still remained a chance of dropping rock, into the new branch of the river thus opened, faster than the water could undermine and bury it. Orders were issued to all quarries within some 400 miles to load cars with large rock, and locomotives were pressed into service to rush the loaded cars to the work. Night and day the material thus obtained was dumped into the waterway. In the meantime the rock fill, already well advanced in the main channel of the heading, was lowered by rolling rocks from its crest, thereby increasing the flow over this barrier and reducing the flow in the by-pass channel. This operation was successful. The by-pass was completely closed on October 27th, and the dam in the main arm of the heading raised to full height, the difficulties decreasing as the volume of flow down the river's proper channel gradually increased with the increasing height of water surface. When finally the water surface had been raised 14 ft., the

entire flow of the river was in the original channel. The river was thus completely turned on November 4th.

It had been foreseen by the engineers that the deterioration of the river channel below the Lower Mexican heading, which had occurred during the year in which the river flowed inland, would result in higher water surface elevations than had theretofore prevailed. Earth dikes or levees, therefore, were extended up and down stream from the rock dam in the canal heading. These were made 10 ft. wide on top, and had side slopes of 2 to 1. They were built of material taken from borrow-pits on the canal side.

During the last days of November and early in December heavy rains on the headwaters of Gila river sent a freshet flow down this stream, which reached its maximum at Yuma on December 7th. The water rose to 26.2 ft. on the gage at that point (about 7 ft. above low water), and the river's flow had been increased from about 10,000 to a maximum of 56,000 cu. ft. per second. A levee had just been built from the rock dam in the canal heading up and down stream. It was found that the porous material on which this rested would allow considerable underflow. There was a concentration of such underflow at a point about one-half mile south of the rock dam, and the water quickly cut a passage into which the levee collapsed. This occurred early in the morning of December 7, when the water stood about 3 ft. deep against the levee.

The break in the levee rapidly widened to 800 ft. The waters flowed north toward the canal heading, and dropped into the channel from which the river had so recently been turned. The flow along the levee could not be withstood, and soon another section, some 500 ft. long, nearer the rock dam, was cut away. Within a few days the river had cut a channel through the yielding bank deep enough to put its entire flow back upon its inland course. The entire flow of the Colorado is again concentrated in the water-courses which lead into Salton Basin. [According to our records this break was closed at 6 p.m., February 11.—Ed.]

To illustrate the progress of the change from the river's proper course to its inland channel the original lower heading in October, 1904, had a width of from 40 to 50 ft. and a depth of from 6 to 8 ft. It had been enlarged to a width of about 100 ft. and a depth of about 20 ft. by the end of June, 1905. It had become the main channel of the river in December, 1905; was from 300 to 600 ft. wide in March, 1906, and more than one-half mile wide at some points in June, 1906. Subsequent to June, 1906, during its falling stages, the river built out sand bars from the northern bank of the cut, and soon thereafter had concentrated its water in a channel generally about 600 to 800 ft. wide, the south bank of which was from 3,000 to 4,000 ft. from the original north bank of the canal heading.

The immense energy of the spring flood of 1906 which poured into Salton Basin was not long in cutting great barrancas some hundreds of feet wide and from 40 to 80 ft. deep, into the alluvial soil of the Imperial Valley. The upper lip of a barranca of this kind on New river was at a point due west from Imperial on March 15th. In two months it traveled up stream some 15 miles to within a short distance of Calexico. It is reported to have progressed over parts of this distance nearly a mile in a day. Opposite Imperial, at the beginning of the year, the river was in a slight depression, practically on top of the ground, but in August it was a chasm 80 ft. deep and upwards of 1,100 ft. wide. Near Calexico the cutting of the barranca approached dangerously close to the town. It took some of the railroad land, all the railroad improvements at Mexicali, and many of the adobe buildings of that town, and left the remainder of these towns some 40 ft. above the plane of the river's water which, but a few days before, had covered the surrounding country 4 or 5 ft. deep and had threatened destruction by inundation. It has been estimated that from 400,000,000 to 500,000,000 cu. yds. of material have been thus excavated by the river water and "ground-sluiced" into Salton sea.

Not only has the river been carving out the great barranca above described, but, throughout the course along which the water flows from near Pilot Knob to New river, the swirling waters have deepened the channel here and widened it there until a broad continuous channel has taken the place of the original poorly defined channels through miles of mesquite thickets. Month by month, as channel capacity has thus increased, the river has burrowed deeper into the ground at the critical point, at the Lower Mexican heading, and thus, as time went on, the height that water must be raised to send it down the proper channel has increased. At the same time there was a deterioration of the proper river channel below the heading. The last of the water taking that course built up sand bars for some miles down stream, and these, temporarily at least, are in the way of the restored flow. The growth of weeds and willows in the river-bed while dry is a further unwelcome obstruction. In the spring of 1905 the water surface was already so low in the new river channel that a waste-gate in the south canal bank, some eight miles from the Colorado, had been left high in the air. The water was too deep in the ground to continue to flow into it. The cutting off of the discharge of the Colorado into the gulf was complete after August, 1906.

GENERAL NEWS SECTION

NOTES.

The workmen in the shops of the Philadelphia & Reading are now working 13 hours a day.

The Southern Pacific is reported to have imported from Japan 1,500,000 oak ties for its California lines.

A press despatch from Baltimore says that the Baltimore & Ohio Railroad has greatly reduced its engineering forces.

The state of West Virginia has passed a law limiting the working hours of telegraph operators, which is to go into effect May 9. The railroads say that they are going to make a proportionate reduction of pay, and the operators announce that they will accept nothing less than what they now receive for 12 hours.

The Delaware & Hudson has made a general increase in the wages of its enginemen. President Murray, of the Baltimore & Ohio, announces that the wages of the employees of the B. & O. have been increased an aggregate of nearly \$3,000,000 annually. No horizontal advance has been made, but employees most faithful and deserving have been "rewarded."

The Interstate Commerce Commission has received a complaint from Chicago declaring that in the middle western states the express companies do a regular commission business, thus greatly interfering with the prosperity of regular commission merchants. It is alleged that the express agents buy goods for which no purchasers have been found, and that at destination the agents run peddling carts.

The Chicago reporters, having worked up a great interest (among themselves) in alleged proposed reductions in the speed of fast trains on all of the big railroads, are now engaged in letting themselves down again, the suggestion that speed should be reduced having been badly "frosted" by the protests of certain cities between Chicago and the Pacific coast, where it is felt that business will be much disturbed if mail trains are made to arrive any later than they do now.

The Nebraska legislature has passed a law to provide for the taxation of railroad property in cities and villages for local purposes, the same as other property. It is said that the law will put an increased burden of \$500,000 yearly on the railroads of the state. The bill provides that the franchise value of roads shall be included in the property subject to this tax, except that the valuation shall be distributed through the state, instead of taxed in the bulk in the local community.

The Car Service (Demurrage) Associations in the territory south of the Potomac and Ohio rivers and east of the Mississippi have made their rules uniform. This will greatly simplify the work of dealing with demurrage questions on railroads which are members of a number of different associations. The most important change that has been brought about by the simplification of the rules is the abolition of all exceptions to the 48-hour rule. Henceforth two days will be the limit of free time for the unloading of all commodities.

On Saturday, March 23, the fast train of the Colorado & Southern, engineman J. O. Thompson, was run from Trinidad to Denver, 120 miles, in 2 hours 30 minutes, or at the rate of 48 miles an hour, including all stops. This time is 20 minutes shorter than the best heretofore made. While, for a road with 40-mile tangents, this would not be remarkable speed, the performance is looked upon by those acquainted with the C. & S. as very creditable for, as we are informed by a correspondent, "the line between the cities named has so many steep grades and sharp curves that an eastern engineman would look twice before he tackled it."

The Cost of Team Hauls of Agricultural Products.

At the second annual banquet of the Jamestown (New York) Chamber of Commerce, held March 29, Luis Jackson, Industrial Commissioner of the Erie Railroad, made a comparison of the expense of hauling agricultural products to the railroad station with the expense of carrying them on trains. His facts were taken from a recently issued bulletin of the Department of Agriculture, showing the cost of hauling crops by teams from farm to railroad station.

Taking 23 kinds of agricultural products, from apples to wool, the average cost of the team haul was found to be 11 cents per 100 lbs., and the average cost per ton mile 23 cents. Detailed figures were given for the three great staples, wheat, corn and cotton. The following were the average figures for wheat: Miles to shipping point, 9.4; pounds in one load, 3,323; cost to farmer per load, \$2.86; cost per 100 lbs., 9 cents; cost per ton per mile, 19 cents.

For corn: Miles to shipping point, 7.4; pounds in one load, 2,696; cost to farmer per load, \$1.78; cost per 100 lbs., 7 cents; cost per ton per mile, 19 cents.

For cotton: Miles to shipping point, 11.8; pounds in one load, 1,702; cost to farmer per load, \$2.76; cost per 100 lbs., 16 cents; cost per ton per mile, 27 cents.

The average earnings per ton per mile on the Erie Railroad are a fraction less than 6 mills. Railroad rates are about as low as we can get them, and the moral of the figures for team hauls is that we must improve our country roads and possibly get automobiles to haul the products to the station. All this is a matter for the earnest consideration of the farmer, the manufacturer and the commercial man.

Scholarships for P. R. R. Employees' Sons.

The children of the late Frank Thomson, Annie, Frank and Clarke, have given to the Pennsylvania Railroad \$120,000 to establish the "Frank Thomson scholarships" to give the sons of living or dead employees of the lines of the system an opportunity for a technical education. Competitive examinations will be held, beginning this year, for two scholarships, each of which amounts to \$600 a year. Two will be added each year, and after four years two will be given annually, keeping a total of eight in college or school all the time.

Train Wreckers Near Pittsburg.

Two fast passenger trains of the Pennsylvania Railroad have been derailed near Pittsburg by wreckers within five days, and the company has offered a reward of \$2,500 for the conviction of the guilty person or persons in each case, and \$500 for information leading to the arrest of any of them, \$5,500 in all. The trains were the westbound Chicago Limited of March 22d, derailed at Stewart, 17 miles east of Pittsburg, at 4 a.m., and the eastbound Keystone Express of March 27th, derailed at Wilmerding, 12 miles from Pittsburg, at about the same hour. In both cases rails were loosened, but care was taken to leave the bond wires at the joints unbroken so that the automatic block signals should not indicate stop. In the first case the tools used in loosening the track, which were found nearby, were not those of the company, but in the second case they had been taken from a chest not far away. On the second occasion the rails of two main tracks had been loosened. In the first derailment the engineman and 18 of the 83 passengers were injured, the engine was overturned and the mail car took fire from the engine, but in the other all on the train escaped without serious injury, though the derailment occurred on a curve.

Twenty-four Passengers Killed at Colton, Cal.

In a derailment on the Southern Pacific at Colton, Cal., March 28th, 24 passengers and a section master (who was not on the train) were killed, and about 60 were injured, eight of the injured being seriously hurt. The men in charge of a switching train had left a switch open and the passenger train, the westbound Sunset Limited, about 12 hours behind time, came on at such high speed that its engine was overturned and the first three cars were wrecked. Of the killed 22 were Italian immigrants or laborers riding in the day coach and the smoking car.

New Railroad Laws.

The legislature of Colorado, which has adjourned, has passed a bill to appoint a state railroad commission of three members. The Governor of Nebraska has signed the bill establishing a railroad commission in that state and regulating railroad rates. Press despatches indicate that under this and another law rates on grain, live stock, lumber, coal and other commodities must be reduced 20 per cent.; but there is a provision giving the railroads 30 days in which to make certain changes in tariffs on their own initiative. A bill requiring new issues of railroad stocks or bonds to be approved by the railroad commissioners, was defeated. At Springfield, Ill., last week, Messrs. Winchell of the Rock Island, Willard of the Burlington, Jackson of the C. & E. I. and Daly of the Illinois Central addressed the joint committee of the legislature in opposition to pending bills. The state of Nevada has an elaborate new railroad law. It provides for a board of three commissioners, to receive \$5,000, \$2,500 and \$2,500 salary, respectively (the first to devote his whole time to the work), and prescribes maximum freight rates. On ores there are nine different rates per ton per mile, and are graduated according to the value of the ore.

The Indiana Railroad Commission has issued a statement of the

changes and additions to the laws concerning railroads in that state since 1902. First is named the two-cent fare law, just passed, which will become effective when the acts are published about the middle of this month. There are thirteen sections relating to the prohibition of dangerous structures and the use of safety appliances. These deal with power brakes, grab irons, couplers, safety appliances for passenger trains, air-brakes on motor cars and overhead bridges sufficiently above the track. Inspectors are provided for. Commercial travelers' samples must be carried as baggage, and the charge for excess is to be one cent for three miles for each 100 lbs., the minimum charge to be 25 cents on less than 500 lbs. and 50 cents on over 500 lbs. Power is given the commission to require that cars go forward at an average of fifty miles a day; that cars be set for unloading within 24 hours after they have been received, and to be furnished within 48 hours after a demand is made. There must be a full crew of five or more men for all freight trains having fifty cars or more, and for all passenger trains having five cars or more. All companies operating dining cars and selling liquors must pay a state license of \$1,000. Laws concerning train rules and requiring the use of the block system are referred to elsewhere in the *Railroad Gazette*.

Immigration to Western States.

The Western Passenger Association has issued a comparative statement of the immigrant business passing through all ports of entry destined to Western states from 1900 to 1906 inclusive. The number of immigrants steadily increased up to 1904, when it showed a falling off. In 1905 again it showed a decided increase, and 1906 was the largest year, with a total of 94,507.

The figures are taken from the reports of the railroad agents ticketing the passengers from ports of entry. It shows that a total of 499,665 people have moved into the West during the seven years from foreign countries. Following are the totals by states:

Alaska	2	Montana	9,612
Arizona	1,846	Nebraska	17,504
Arkansas	1,055	Nevada	3,960
British Columbia	2,342	New Mexico	1,102
California	70,958	North Dakota	17,236
Colorado	22,781	Oklahoma	677
Idaho	2,295	Oregon	7,341
Illinois	50,957	South Dakota	15,534
Indian Territory	1,683	Texas	2,097
Iowa	32,133	Utah	6,935
Kansas	10,554	Washington	17,800
Mexico	122	Wisconsin	66,689
N. Michigan	57,599	Wyoming	4,240
Minnesota	79,484		
Mississippi	10		
Missouri	11,819		
		Total	499,665

—Chicago Tribune.

Railroading in Porto Rico.

According to James Peabody, who has been investigating the railroads of Porto Rico at the invitation of Governor Winthrop, the lines are in a very bad condition, due primarily to the fact that most of the funds originally received for building the roads were used in bribes to Spanish officials. The American Railroad of Porto Rico includes all the railroad mileage. It is a single-track, meter-gage line 200 miles long, including a branch. It connects San Juan, on the north shore of the island, with Ponce, on the south shore, by a roundabout course running along the northern and western coasts. There is, however, a 25-mile gap in the line between these points, which is covered by automobiles. Mr. Peabody is quoted as follows:

"The railroad passenger service on the island is pitiable. Not one of the passenger cars has a brake on it. The only brake for a passenger train is the one on the locomotive. As some of the grades of the railroad are steep, it is distressing to think what would happen if a train should break in two going up one of the grades. There would be no way to stop the cars that got away from the locomotive.

"There were no bell-cords on the trains when I began to investigate the system. One of my first recommendations was to have bell cords connecting the cars with the locomotive. The conductor used to poke his head out of a window and blow a blast on a pocket whistle when he wanted to stop a train between stations. I was on a train one day when a rear car got off the track. The conductor tried to stop the train, but the locomotive happened to be blowing off steam at the time, and the engineer could not hear the pocket whistle. We kept going ahead, with the rear car bumping along on the ties. Finally the conductor drew a pistol and fired a shot out of the window, and the engineer heard the shot and pulled up. I asked the conductor if he had shot at the engineer.

"The freight cars have brakes, but the brakes are so arranged that they can be set only from the ground, after the car is stopped. The reason for that is that nobody ever wants to stop a freight car there until it is on a siding where it is to be loaded or unloaded. It sometimes happens that a freight car breaks loose from the locomotive on a grade, and there is a smashup, but that does not seem to worry anybody.

"As there are practically no wagon roads, the sugar planters have

many movable railroad tracks leading to their plantations, the cars on such tracks being hauled by mules. They think nothing of running one of the movable tracks across the railroad track. The engineers of the railroad have to keep constant lookout for one of these obstructions. There are many private sidings for freight cars along the line of the railroad, also, and it often has happened that a car has run off the siding to the main track in the way of a train. One of my recommendations was for a derailing switch at every siding."

Mr. Peabody has drafted a set of regulations for the passenger service, and a budget for the next five years based on the amount of former business and the new freight tariff.

The Cape Cod Canal.

The Cape Cod Canal Construction Co., recently incorporated in Maine, and of which August Belmont, of New York, is President, has contracted to dig the Cape Cod Canal from Barnstable, Mass., to Buzzard's Bay, for \$11,999,000. This is the first estimate of its kind for the construction of the canal made by any construction company since the first canal was started nearly twenty years ago. It is said that work will be begun by the middle of May, provided that the Massachusetts Railroad Commission approves certain plans by that time. W. B. Parsons is to be Engineer in charge of the work, and J. B. McDonald, Vice-President of the construction company, will be in charge of the labor department.

An Improved Compressed Air Forge.

The Buffalo Forge Co., Buffalo, N. Y., has recently put on the market a new and improved compressed air forge which is shown in the accompanying illustration. It is listed as No. 22C. In the previous models a tiny jet of compressed air was made to impinge on the blades of a fan wheel causing it to revolve within a casing



Buffalo Compressed Air Forge.

in such a way as to act as an ordinary centrifugal fan, drawing in through the inlet to the casing 40 times the volume of compressed air used and forcing it all to the tuyere. The design of the improved forge, however, is radically different. There are no moving parts requiring oiling or attention to keep clean. The clinker falling through the tuyere drops to the ground of itself and the windbox cannot become clogged. Compressed air from the shop system passes through a small globe valve and 1/4-in. pipe to a one-piece vertical windbox directly beneath the bowl and tuyere. At the lower end of the windbox is placed the compound nozzle which works on the injector principle. The use of a small jet of compressed air at high velocity in the nozzle delivers a large volume of air at moderate pressure to the tuyere. The design is neat and compact and has no projecting parts. The weight is only 65 lbs., which makes the machine readily portable. Any desired intensity of blast may be secured, and the large tuyere bowl allows a deep fire to be carried. On account of the simple construction the forge can be sold at a low price. It is adapted for bridge and tank builders, railroad and car shops, boiler makers' and contractors use.

Steel Plant To Be Built at Duluth.

The United States Steel Corporation has authorized the construction of a new steel plant at Duluth. Steel rails, structural shapes and bars will be manufactured. It is expected that the plant will cost about \$10,000,000. The cost of building the plant will be charged to surplus. A site has already been selected for the plant and work is to be begun at once.

Traffic Club in Chicago.

Following the successful beginning of the New York Traffic Club organized last summer, a similar organization has been formed in Chicago with the following officers:

Frank T. Bentley, Traffic Manager Illinois Steel Co., President; Darius Miller, Vice-President of the Chicago, Burlington & Quincy; Frank A. Spink, Traffic Manager of the National Packing Co.; and George H. Ingalls, Freight Traffic Manager of the New York Central Lines West, Vice-Presidents; M. S. Connelly, General West-

ern Freight Agent of the Pittsburg, Cincinnati, Chicago & St. Louis; Treasurer; and John T. Stockton, Manager of the Joseph Stockton Co., Secretary.

New General Manager of the Public Service Corporation.

R. E. Danforth, Manager of the Rochester Railway, has been appointed General Manager of the street railways owned by the Public Service Corporation of New Jersey, succeeding A. H. Stanley, who recently resigned to go to London as General Manager of the Underground Electric.

Maintenance Cost of English Highways.

United States Consul Walter C. Hamm, of Hull, England, reports as follows on the maintenance of highways in Yorkshire: The roads were well constructed originally and are well cared for now. It is a rare sight to see a rutty or muddy country road in this neighborhood. Most all of them are macadamized, well-drained and kept in good repair. As a consequence one horse can draw a load which would require two or three horses over the usual country road in America. The following table gives the total expenditure for each year, the total length of roads in the district considered, and the average cost per mile for 12 years past. The pound sterling is estimated at \$5:

Year	Total cost.	Miles.	Cost per mlie.
1895.....	\$734,270	1,122	\$654
1896.....	741,925	1,122	661
1897.....	787,940	1,122	702
1898.....	826,120	1,125	735
1899.....	812,850	1,128	729
1900.....	766,765	1,133	768
1901.....	789,295	1,111	710
1902.....	793,950	1,107	717
1903.....	796,990	1,104	724
1904.....	839,160	1,094	767
1905.....	879,320	1,094	804
1906.....	910,750	1,094	832

As will be seen, there is a constant tendency to increase in the cost of maintenance, but this increase is, in part, accounted for by the construction of footpaths and the placing of granite "sets" to protect the roads from injury by trolley lines.

Manufacturing and Business.

The name of the Sawyer-Man Electric Company has been changed to the Westinghouse Lamp Company.

Part of the plant of the Maryland Steel Car Wheel Co. at South Baltimore, Md., was burned on March 30. The damage is estimated at from \$60,000 to \$100,000.

Walter D. LaParle, Manhattan Building, Chicago, has been appointed Chicago representative of the Helwig Manufacturing Co., St. Paul, Minn., and sole railroad representative of the Automatic Oil Cup Co., Milwaukee, Wis.

The Philip Carey Manufacturing Co., Lockland, O., has begun work on two new brick and concrete factory buildings 80 ft. wide x 400 ft. long, which, it is expected, will be ready by September 1. All building material and equipment have been ordered.

The Wason Manufacturing Co., Springfield, Mass., has been taken over by the J. G. Brill Co. The last named company has sold \$1,270,000 preferred stock, part of the proceeds of which were used for the acquisition of the smaller car-building company.

G. S. Brantingham, Second Vice-President of D. E. Baxter & Co., railroad contractors, New York, and Charles M. Meeker, New York, have been elected Directors of the Lake Superior Southern, which is being built from Madison, Wis., north to Huron Bay, Mich., by D. E. Baxter & Co.

The Cleveland-Cliffs Iron Co. has ordered a 60-drill air compressor from the Sullivan Machinery Co., Chicago, for its new Maas mine at Negaunee, Mich. The machine will be the Corliss cross-compound, condensing, two-stage type, with large receiver inter-cooler. The steam cylinders will be 24 and 46 in. x 48 in., and the air cylinders 24 and 40 in. x 48 in., with a displacement capacity of 4,000 cu. ft. of free air per minute at 60 r.p.m., or nearly 5,000 ft. at 70 r.p.m. The compressor will be built at the Chicago works of the Sullivan Machinery Co.

The Union Switch & Signal Company recently bought 34 acres of land adjoining the plant at Swissvale, Pa. The company has decided to grade 10 acres of this plot at once, on which switching tracks will be put in, and to which site the lumber yard will be removed. Plans are being drawn for a new building to contain a foundry, a blacksmith shop and a power house, giving the company 140,000 additional square feet of floor space for manufacturing purposes. The business of the company increased 70 per cent. last year, and from present indications the gross earnings this year will be about \$10,000,000.

Alva J. Grover, formerly resident engineer on the Wisconsin Central, was recently appointed, through Hapgoods of Milwaukee, inspecting engineer in charge of railroad construction in the Philippines for the United States Bureau of Insular Affairs. Mr. Grover is 49 years old and a graduate of the University of Wisconsin, class of 1881. From 1898 to 1899 he was transitman, assistant engineer on location and chief of locating party on the Union Pacific. In 1901 he was made resident engineer of the Choctaw, Oklahoma & Gulf. Later he had charge of construction work at Ramsdell, Tex., in addition to building 11 miles of road near Guthrie, Okla. After the absorption of the road by the Chicago, Rock Island & Pacific he was appointed resident engineer of the last named company in charge of soundings for permanent bridge foundations on lines between Haileyville and Kansas City. In 1903 he went to the Pittsburg, Shawmut & Northern R. R. at Smethport, Pa., where he finished the line between Clarumont and Kasson Junction and made permanent revision of the line between Kasson and Caryville, Pa. He then was made Assistant Division Engineer of the Chicago, Milwaukee & St. Paul at Milwaukee, and later went to the Wisconsin Central, to take the office which he has now left to go to the Philippines.

Iron and Steel.

Among the orders recently placed for rails were 6,000 tons for the American Electric Co. of Idaho, 2,000 tons for the Oakland Consolidated Co., California, and 700 tons for the Augusta, Oakland & Waterville, of Maine.

Contracts for steel for bridges have been let as follows: Pennsylvania Steel Co., 4,000 tons for the Chicago, Milwaukee & St. Paul; 1,600 tons to the Morava Bridge Co. for the Chicago Terminal Transfer Co.; 700 tons for the Lehigh Valley, and 250 tons to the Boston Bridge Co. for the Boston & Maine.

The Chicago, Milwaukee & St. Paul has ordered 21,000 tons of structural steel for its Pacific coast extension, as follows: Between 8,000 and 9,000 tons from the Pennsylvania Steel Co., 7,000 tons from the American Bridge Co., and the rest from the McClintic-Marshall Construction Co., and several other companies.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, see advertising page 24.)

American Society of Civil Engineers.

At a meeting of this society, April 3, a paper on "Movable Bridges," by C. C. Schneider, was presented for discussion. This paper was printed in the *Proceedings* for February, 1907.

The American Railway Association.

The spring meeting of the American Railway Association will be held at the Auditorium, Chicago, on Wednesday, April 24. Reports will be presented by the Executive Committee and the Committees on Train Rules, on Car Service, on Safety Appliances, on Statistical Inquiry, on Standard Cipher Code, on Transportation of Explosives, on Standard Rail and Wheel Sections, on Standard Location of Third Rail Working Conductors, and on Car Efficiency. The election of a President and a Second Vice-President will take place at this meeting.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Astoria & Columbia River.—F. D. Kuetner, Auditor, has also been appointed Auditor of the Columbia River & Northern, and his office has been moved from Astoria to Portland.

Atchison, Topeka & Santa Fe.—See Atchison, Topeka & Santa Fe Coast Lines.

Atchison, Topeka & Santa Fe Coast Lines.—W. J. Healy, Freight Auditor of the Atchison, Topeka & Santa Fe, has been appointed Auditor of the Coast Lines, succeeding G. A. Davidson.

Brimstone Railroad & Canal.—The officers of this company are: President, J. Tonietto; Vice-President, J. L. Henning; Secretary, S. W. Maxwell, all with office at Sulphur Mines, La. General Manager, Henry Whiton, and Traffic Manager, J. P. Magill, both with office at New York.

Chicago, Ziegler & Gulf.—F. M. Wakefield has been elected Vice-President.

Great Northern.—J. J. Hill, President, has been elected Chairman of the Board. L. W. Hill, Vice-President, succeeds Mr. Hill as President.

Grand Trunk.—W. G. Brownlee, Superintendent of the Middle divi-

sion, has been elected Fourth Vice-President, succeeding F. H. McGuigan, resigned to go to the Great Northern.

Intercolonial.—The Hon. H. R. Emerson, Minister of Railways, has resigned.

Isthmian Canal Commission.—R. R. Rodgers, General Counsel, has been appointed a member of the Commission.

Litchfield & Madison.—F. M. Campbell has been appointed Auditor, Secretary and Treasurer, with office at Edwardsville, Ill., and the office of Assistant Treasurer, formerly held by H. W. Berger, has been abolished.

Louisiana Railway & Navigation Co.—The office of the President has been removed from New York to New Orleans.

Norfolk & Western.—J. I. Doran, General Solicitor, has been appointed General Counsel, with office at Philadelphia. T. W. Reath succeeds Mr. Doran.

Pacific Coast Company.—J. B. Amos, Assistant General Auditor, has resigned, and the office has been abolished.

Pecos System.—A. E. Meyer has been appointed Auditor of the Pecos Valley & Northeastern and of the Pecos & Northern Texas, with office at Amarillo, Tex., succeeding D. A. Sweet, resigned.

Pennsylvania Lines West.—J. L. Mason has been appointed Assistant Secretary, with office at Pittsburg. See Pittsburg, Wheeling & Kentucky.

Philadelphia & Reading.—G. S. Hanley has been appointed Assistant to the First Vice-President.

Pittsburg, Wheeling & Kentucky.—E. B. Taylor, Third Vice-President of the Pennsylvania Lines West, has been elected also President of the Pittsburg, Wheeling & Kentucky, which is operated as part of the Southwest system of the Pennsylvania Lines West, succeeding W. P. Hubbard, resigned. Joseph Wood, First Vice-President of the Pennsylvania Lines West, has been elected also Vice-President of the Pittsburg, Wheeling & Kentucky, succeeding James McCrea, resigned.

Rio Grande, Sierra Madre & Pacific.—L. D. Baldwin has been elected Vice-President.

Trinity & Brazos Valley.—W. E. Greene has been elected Vice-President and General Manager, succeeding M. Sweeney, resigned to go into other business.

Western Maryland.—Alexander Robertson, General Manager, has been elected Vice-President, succeeding F. S. Landstreet.

Wichita Valley.—Frank Trumbull is Chairman of the Board, and J. S. Mackle, Assistant Secretary and Assistant Treasurer; both with office at New York.

Operating Officers.

Canadian Pacific.—F. F. Busted, Assistant Chief Engineer of Western lines, has been appointed General Superintendent of the Pacific division, with office at Vancouver, B. C., succeeding R. Marpole, promoted. The Central division has been divided as follows: Fort William terminals, consisting of the line from Port Arthur to Westfort; First district, with headquarters at Kenora, Ont.; Second district, with headquarters at Winnipeg, Man. Winnipeg terminals, consisting of the lines from Whittier Junction to Rugby Junction and St. Boniface; Third district, with headquarters at Brandon, Sask.; Fourth district, with headquarters at Brandon, and Fifth district, with headquarters at Moose Jaw, Sask. J. G. Taylor, Assistant Superintendent at Fort William, has been appointed Superintendent of Fort William terminals. C. S. Maharg, Assistant Superintendent at Brandon, Sask., has been appointed Superintendent of the Third district. G. E. Graham, Assistant Superintendent at Moose Jaw, has been appointed Superintendent of the Fourth district.

Chicago & Illinois Midland.—M. A. Zook has been appointed Superintendent, with office at Pawnee, Ill., succeeding C. F. Clendenen.

Chicago, St. Paul, Minneapolis & Omaha.—G. W. Steen has been appointed Superintendent of Dining Cars, with office at Minneapolis, Minn., succeeding I. H. Shattuck, deceased.

Colorado & Southern.—J. H. Young, General Manager, has resigned to go to another railroad company, and the office of General Manager has been abolished. J. D. Welsh has been appointed to the new office of General Superintendent in charge of transportation, motive power and maintenance of way. See St. Louis & San Francisco.

Erie.—R. C. Thurston has been appointed Supervisor of Electric Service, with office at Avon, N. Y.

Fort Smith & Western.—See St. Louis, El Reno & Western.

Fort Worth & Denver City.—O. E. Maer has been appointed Trainmaster at Childress, Tex., succeeding J. H. Riegel, resigned.

Galveston, Harrisburg & San Antonio.—Richard Jones, Assistant Superintendent of the Victoria division, has been appointed Superintendent of that division, succeeding G. Radetzki, resigned to go to the Houston & Texas Central.

Grand Trunk.—C. S. Cunningham, joint Superintendent of the Wabash and the Grand Trunk at St. Thomas, Ont., has been appointed Superintendent of the Middle division, with office at Toronto, Ont., succeeding W. G. Brownlee, promoted. U. E. Gillan, Assistant Superintendent of the Grand Trunk, succeeds Mr. Cunningham. See this company under Executive, Financial and Legal Officers.

Hocking Valley.—See Toledo & Ohio Central.

Kanawha & Michigan.—T. M. Connors, Superintendent of the Toledo & Ohio Central, has been appointed Superintendent of the Kanawha & Michigan, with headquarters at Charlestown, W. Va., succeeding W. C. Franz, who has been appointed General Manager of the Kanawha & West Virginia, with headquarters at Charlestown, W. Va.

Mexican Central.—H. Putnam, Assistant Purchasing Agent, has been appointed Superintendent of Car Service, with office at Mexico City.

Maricopa & Phoenix & Salt River Valley.—C. M. Scott, formerly chief clerk to the President, has been appointed Superintendent, succeeding M. O. Bicknell, transferred.

Northern Pacific.—The Idaho division, from Trout Creek, Mont., west to Ellensburg, Wash., will hereafter be operated in two divisions. The Idaho division will hereafter consist of the line from Spokane, Wash., to Trout Creek, and the Washington Central, the Palouse and the Lewiston branches. The new Pasco division will consist of the line from Spokane to Ellensburg, including the Sunnyside branch. J. L. De Force, Trainmaster at Spokane, has been appointed Superintendent of the new division, with office at Pasco, Wash. The change is effective May 1.

Pennsylvania.—W. C. Coughlin, Superintendent of the Elmira & Canandaigua division, has been appointed Superintendent of the Middle and Western divisions of the Erie grand division, succeeding T. A. Roberts, deceased. H. A. Jaggard, General Agent at Pittsburg, succeeds Mr. Coughlin. James Buckelew, Superintendent of the P., B. & W. at Media, Pa., has been appointed Superintendent of the Allegheny division. C. T. Dabney succeeds Mr. Buckelew. A. J. Whitney, Jr., Principal Assistant Engineer of the Eastern Pennsylvania grand division, has been appointed Superintendent of the Delaware division of the P., B. & W., succeeding R. S. Holliday, deceased.

W. C. Copley, Assistant Trainmaster of the Middle division, has been appointed Freight Trainmaster of that division, succeeding J. B. Fisher, promoted.

Pennsylvania, New York & Long Island.—C. S. Krick, Assistant Engineer of the Philadelphia terminal division of the Philadelphia, Baltimore & Washington, has been appointed Superintendent of the Pennsylvania, New York & Long Island, which is building that part of the Pennsylvania's New York improvements extending from the center of the Hudson river east across Manhattan Island and under the East river to Long Island City.

Philadelphia, Baltimore & Washington.—See Pennsylvania.

Pullman Company.—W. H. Deal, Assistant Superintendent at Detroit, Mich., has been appointed Assistant Superintendent at Norfolk, Va. F. L. Wood succeeds Mr. Deal.

St. Louis & San Francisco.—J. H. Young, General Manager of the Colorado & Southern, has been appointed General Superintendent of the First district of the St. Louis & San Francisco, with office at Springfield, Mo., succeeding Andrew O'Hara, who has been Acting General Superintendent, and has now been re-appointed Superintendent at Springfield, Mo. H. H. Brown, Superintendent at Springfield, Mo., has been appointed Superintendent at Memphis, Tenn., succeeding A. D. Lightner, transferred to Birmingham, Ala., as General Agent of the St. Louis & San Francisco, and General Manager of the Birmingham Belt. A. J. Sams, Superintendent at Birmingham, Ala., has been appointed Superintendent at Enid, Okla. T. B. Coppage, Superintendent of the Gulf, Colorado & Santa Fe at Temple, Tex., succeeds Mr. Sams. J. W. Walton has been appointed Superintendent of the Red River division, with office at Francis, Ind. T.

St. Louis, El Reno & Western.—B. F. Beckman, Engineer of Maintenance of Way, has been appointed to the new office of Superintendent of this road, and of the Fort Smith & Western, with office at Fort Smith, Ark., and the office of Engineer of Maintenance of Way has been abolished.

Southern.—G. R. Loyal, General Superintendent of the Eastern district, has been appointed General Superintendent of the Middle

district, with office at Knoxville, Tenn., succeeding M. M. Richey, promoted. H. E. Hutchens, Superintendent at Memphis, Tenn., succeeds Mr. Loyal, with office at Charlotte, N. C.

Toledo & Ohio Central.—C. L. Gardner, Trainmaster of the Hocking Valley at Columbus, Ohio, has been appointed Assistant Superintendent of the Toledo & Ohio Central, with office at Bucyrus, O., succeeding T. M. Connors, appointed Superintendent of the Kanawha & Michigan.

West Virginia.—See Kanawha & Michigan.

Traffic Officers.

Bennettsville & Cheraw.—G. P. Bourdelat, Auditor of the Aberdeen & Rockfish, has been appointed Traffic Manager of the Bennettsville & Cheraw, with office at Bennettsville, S. C.

Chicago & Calumet River.—Clive Runnells, Traffic Manager, having resigned, matters regarding traffic originating on the lines of the company are now handled by A. P. Bowen, Purchasing Agent, and claims are handled by W. K. Stuart, Assistant Auditor.

Chicago & North-Western.—H. G. Graves has been appointed Acting General Baggage Agent, with office at Chicago, succeeding to the duties of F. D. Taylor, General Baggage Agent.

Chicago, Milwaukee & St. Paul.—W. B. Dixon has been appointed Assistant General Passenger Agent, with office at St. Paul, Minn.

Chicago, Ziegler & Gulf.—W. B. Clark has been appointed Traffic Manager.

Cincinnati, Lebanon & Northern.—J. P. Romey, General Agent at Middletown, Ohio, has been appointed General Agent at Cincinnati, succeeding George Hooke.

Cleveland, Cincinnati, Chicago & St. Louis.—F. L. Talcott has been appointed General Eastern Freight Agent, with office at Buffalo, N. Y., of this road and of the Lake Erie & Western, succeeding C. E. Crane.

Durham & Southern.—S. H. Reams has been appointed General Freight and Passenger Agent, succeeding to the duties of R. I. Cheatham, Traffic Manager, resigned to go to the Seaboard Air Line.

Erie.—H. E. Huntington, General Agent at Cincinnati, has been transferred to Buffalo, succeeding H. A. Jaeger, deceased. A. C. Hilton, General Agent at San Francisco, succeeds Mr. Huntington.

Fort Smith & Western.—See Oklahoma Central.

Galveston, Harrisburg & San Antonio.—A. W. Reeves, General Agent of the Houston & Texas Central at Mexico City, has been appointed General Agent of the Galveston, Harrisburg & San Antonio, at El Paso, Tex., succeeding A. W. Cheesman.

Lake Erie & Western.—See Cleveland, Cincinnati, Chicago & St. Louis.

Las Vegas & Tonopah.—E. W. Gillett has been appointed Traffic Manager, with office at Los Angeles, Cal., succeeding H. T. Greene, deceased.

Maricopa & Phoenix & Salt River Valley.—M. O. Bicknell, General Freight and Passenger Agent and Superintendent, has resigned as Superintendent and has been appointed General Freight and Passenger Agent of this road and of the Arizona Eastern, the Arizona & Colorado, the Cananea, Yaqui River & Pacific, and the Gila Valley, Globe & Northern.

Mississippi River, Hamburg & Western.—H. C. Townsend has been appointed General Passenger and Ticket Agent, with office at St. Louis, Mo.

Oklahoma Central.—J. O'Donnell, General Agent of the Fort Smith & Western at Oklahoma City, Okla. T., has been appointed General Freight and Passenger Agent of the Oklahoma Central, with office at Purcell, Ind. T.

Pennsylvania.—J. W. Reynolds, General Agent at Erie, Pa., has retired.

Rutland.—F. E. Barbour, General Agent at Montreal, has been appointed General Passenger Agent.

St. Louis, Watkins & Gulf.—R. F. O'Brien has been appointed General Agent at Lake Charles, La.

Southern.—G. R. Browder, General Freight Agent, has been appointed to the new office of Assistant Freight Traffic Manager at Atlanta, Ga. J. B. Munson, General Agent at New York, has been appointed to the new office of Assistant Freight Traffic Manager at Washington, D. C. Seven General Freight Agencies have been created: J. H. Drake, Assistant General Freight Agent at Richmond, Va., has been appointed General Freight Agent at that place, in charge of lines in Virginia and eastern

and central North Carolina. E. H. Shaw, Assistant General Freight Agent at Birmingham, Ala., has been appointed General Freight Agent at Charleston, S. C., in charge of lines in South Carolina, western North Carolina and terminals at Augusta, Ga. Randall Clifton, Assistant General Freight Agent at Atlanta, Ga., has been appointed General Freight Agent at that place, in charge of lines in Georgia and Florida. H. L. Miller, Assistant General Freight Agent at Knoxville, Tenn., has been appointed General Freight Agent at that place, in charge of lines in eastern Tennessee. R. B. Pegram, Assistant General Freight Agent at Nashville, Tenn., has been appointed General Freight Agent at that place in charge of the Nashville division. I. L. Graves, Assistant General Freight Agent at Memphis, Tenn., has been appointed General Freight Agent at that place, in charge of the Memphis division. R. L. Simpson has been appointed General Freight Agent at Birmingham, Ala., in charge of lines in Alabama excepting the Memphis division.

Texas & Pacific.—W. S. Braggins has been appointed General Agent at New Orleans, succeeding Robert Strong, deceased.

Engineering and Rolling Stock Officers.

Algoma Central & Hudson Bay.—K. J. C. Zinck, Engineer of Maintenance of Way and Construction, has resigned.

Ann Arbor.—See Detroit, Toledo & Ironton.

Chicago, Rock Island & Pacific.—Five Assistant Superintendents of Motive Power have been created: J. B. Kilpatrick, with office at Chicago, formerly Superintendent of Motive Power; W. L. Harrison at Cedar Rapids, Ia., heretofore Master Mechanic at that place; S. W. Mullinix at Topeka, Kan., heretofore Master Mechanic at Horton, Kan.; C. M. Taylor at Shawnee, Okla. T., heretofore Master Mechanic at that place, and F. W. Williams at Fort Worth, Tex., heretofore Master Mechanic at Chickasha, Ind. T.

Colorado Southern, New Orleans & Pacific.—L. F. Lannbladh, principal assistant to the Engineer of Construction of the Southern, has been appointed Chief Engineer of the Colorado Southern, New Orleans & Pacific, with office at Beaumont, Tex.

Detroit, Toledo & Ironton.—The office of Chief Engineer of this road and of the Ann Arbor has been abolished, and reports formerly sent to the Chief Engineer are now sent to C. M. Cornwell, general roadmaster.

The offices of Master Mechanics of this company and of the Ann Arbor have been abolished. W. G. Wallace has been appointed to the new office of Superintendent of Motive Power of both roads, with office at Jackson, Ohio.

Georgia, Florida & Alabama.—J. D. Crawley has been appointed Master Mechanic, with office at Bainbridge, Ga.

Mississippi Central.—W. J. Haynen has been appointed Master Mechanic, succeeding R. M. Boldridge, resigned.

Missouri & North Arkansas.—S. W. Lee, Chief Engineer, has been appointed Consulting Engineer. W. S. Dawley succeeds Mr. Lee. The offices of both are at St. Louis, Mo.

Missouri Pacific.—J. Schumacher has been appointed Master Mechanic at Ferriday, La., succeeding J. W. Ruffner, resigned. F. K. Tutt, Master Mechanic at Van Buren, Ark., has been appointed Master Mechanic at Osawatomie, succeeding W. B. Gaskins, resigned. B. Donohue succeeds Mr. Tutt.

Pennsylvania.—G. W. Snyder, Assistant Engineer of the Pittsburg division, has been appointed Principal Assistant Engineer of the new Western Pennsylvania grand division. A. B. Cuthbert, Assistant Engineer of the Middle division, has been appointed Principal Assistant Engineer of the Eastern Pennsylvania grand division, succeeding A. J. Whitney, transferred.

D. M. Perine, Superintendent of Motive Power of the Philadelphia & Erie and the Northern Central, has been appointed Superintendent of Motive Power of the Western Pennsylvania grand division. D. M. Wallace, Master Mechanic of the Baltimore and West Philadelphia shops, succeeds Mr. Perine.

Philadelphia, Baltimore & Washington.—Elisha Lee, Assistant Engineer of the Philadelphia terminal division of the Pennsylvania, has been appointed Principal Assistant Engineer of the Philadelphia, Baltimore & Washington, succeeding C. S. Krick, transferred.

See Pennsylvania, New York & Long Island under Operating Officers.

Southern Pacific.—J. H. Wallace has been appointed Assistant Chief Engineer, with office at San Francisco.

Trinity & Brazos Valley.—E. T. Mooney has been appointed Master Mechanic, with office at Teague, Tex., succeeding W. C. Burel, resigned.

Purchasing Agents.

Mexican Central.—O. C. Omer has been appointed Assistant Purchas-

ing Agent, with office at Mexico City, succeeding H. Putnam, transferred. See this company under Operating Officers.

Pullman Company.—H. P. Waldon, Assistant Purchasing Agent, has been appointed Purchasing Agent, succeeding W. A. Hughes, deceased. W. T. Stewart succeeds Mr. Waldon.

LOCOMOTIVE BUILDING.

The Tidewater has ordered four locomotives from the American Locomotive Co.

The Western Allegheny is said to be in the market for one 10-wheel locomotive.

The Buffalo Creek has ordered two locomotives from the American Locomotive Co.

The Gulf & Ship Island has ordered six locomotives from the American Locomotive Co.

Corrigan, McKinney & Co. have ordered one locomotive from the American Locomotive Co.

The Missouri, Kansas & Texas has ordered 10 locomotives from the American Locomotive Co.

The Republic Iron & Steel Co. has ordered one locomotive from the American Locomotive Co.

The American Smelter Securities Co. has ordered one locomotive from the American Locomotive Co.

The Central Ontario has ordered four simple 10-wheel locomotives from the Canadian Locomotive Co.

The Mississippi River & Bonne Terre has ordered two locomotives from the American Locomotive Co.

The Henry Cowell Lime & Cement Co., Cleveland, Ohio, has ordered two locomotives from the Baldwin Locomotive Works. These locomotives are to be used on the Bay Point & Clayton Railroad, California.

The Pennsylvania, as reported in the *Railroad Gazette* of March 29, has ordered from its Juniata shops 20 class H6b consolidation (2-8-0) type locomotives; 20 class B8 switching locomotives, and six class E2d Atlantic (4-4-2) type locomotives. The specifications are as follows:

Type of locomotive.	Switching.	Atlantic.	Consolidation.
Weight on drivers	144,100 lbs.	156,700 lbs.	181,170 lbs.
Total weight	144,100 lbs.	190,000 lbs.	204,470 lbs.
Diameter of cylinders	20 in.	20 in.	22 in.
Stroke of pistons	24 "	26 "	28 "
Diameter of drivers	56 "	80 "	56 "
Type of boiler	Belpaire sloping top.	Belpaire wide firebox.	Belpaire wide firebox.
Working steam pressure ..	205 lbs.	205 lbs.	205 lbs.
Heating surface, total.....	1,868 sq. ft.	2,640 sq. ft.	2,442.4 sq. ft.
Firebox, length	66 x 69 in.	72 x 111 in.	66 x 107 in.
Grate area	31.62 sq. ft.	55.5 sq. ft.	49.11 sq. ft.

The Argentine Central has ordered three Shay geared locomotives from the Lima Locomotive & Machine Co., for delivery May 20. Specifications are as follows:

General Dimensions.	
Weight, total	92,000 lbs.
Diameter drivers	32 in.
Cylinders	11 x 12 "
Boiler, type	Extended wagon top
" working steam pressure.....	200 lbs.
" material of tubes.....	Cold drawn steel
" diameter of tubes	2 in.
" length of tubes	11 ft.
Firebox, length	72 1/4 in.
Firebox, width	46 1/4 "
Grate area	23 sq. ft.
Tank capacity	1,750 gals.
Coal capacity	6,500 lbs.

Special Equipment.	
Air brakes	Westinghouse
Couplers	Lima automatic
Injector	Monitor
Piston rod packings.....	Lima Locomotive & Machine Co. metallic
Valve rod packings.....	Lima Locomotive & Machine Co. metallic
Safety valve	Kunkles
Sight-feed lubricators	Nathan Bull's-eye
Steam gages	Ashcroft
Tires, driving wheels	Latrobe Steel Co.

The Yosemite Valley has ordered one simple eight-wheel passenger locomotive from the Rogers Works of the American Locomotive Co., for April 15 delivery, and is considering the purchase of an additional locomotive. Specifications for the eight-wheel locomotive are as follows:

General Dimensions.	
Weight, total	110,000 lbs.
Weight on drivers	72,000 "
Diameter, drivers	36 in.
Cylinders	18 x 26 in.
Boiler, type	Wagon top.
" working steam pressure	165 lbs.
" number tubes	265
" diameter of tubes	2 in.
" length of tubes	11 ft.
Firebox, length	73 1/4 in.
Firebox width	33 3/8 in.
Firebox, grate area	17 sq. ft.
Heating surface, total.....	1,700 sq. ft.
Tank capacity	4,000 gals.
Oil capacity	2,250 gals.

Special Equipment.

Air brakes	Westinghouse
Injector	Ohio
Piston rod packings	Jerome
Valve rod packings	Jerome
Safety valve	Crosby
Sanding devices	Leach
Sight-feed lubricators	Nathan
Steam gages	Crosby
Tires, driving wheel	Midvale

CAR BUILDING.

The Tidewater is in the market for 2,000 coal cars.

Dolese & Shepard, Chicago, have ordered 300 wooden gondola cars from Haskell & Barker.

The Harriman Lines have revised plans on 30 all steel passenger cars and are now asking prices.

The New Berlin & Winfield is said to be in the market for one passenger car and one baggage car.

The St. Louis, Brownsville & Mexico has ordered 200 stock cars from the American Car & Foundry Co.

The Interstate Railway has ordered five gondola cars of 80,000 lbs. capacity from the Ryan Car Co.

The Brinson Railway has ordered 15 flat cars of 60,000 lbs. capacity from the South Atlantic Car & Mfg. Co.

The Grand Rapids & Indiana is said to have ordered 30 passenger cars from the American Car & Foundry Co.

The South Manchuria has ordered 75 passenger coaches, baggage and mail cars from the American Car & Foundry Co.

The Baldwin Lumber Co., Baldwin, La., is said to have ordered 20 narrow gage logging cars from the Orange Iron Works.

The Pennsylvania had not, on April 1, ordered any steel passenger cars, as reported in the *Railroad Gazette* of March 29.

The Litcher & Moore Tramway Co., Fields, La., is understood to have ordered 10 logging cars of 80,000 lbs. capacity from the Orange Iron Works.

The Great Western Oil Refining & Pipe Line Co., Chicago, Ill., has ordered 25 tank cars of 8,000 gallons capacity from the American Car & Foundry Co.

The Harriman Lines are understood to be about to order 275 passenger cars, and are said to have prepared specifications for 3,000 steel underframe box cars.

The Interborough Rapid Transit has ordered 65 elevated railroad cars from the Wason Manufacturing Co. This is understood to be part of the order reported in the *Railroad Gazette* of March 1.

The St. Louis, Rocky Mountain & Pacific is having built at the Madison shops of the American Car & Foundry Company, for delivery about May 15, 300 wooden gondolas of 80,000 lbs. capacity.

The Chicago, Indianapolis & Louisville, as reported in the *Railroad Gazette* of March 29, has ordered 300 40-ft. flat and 200 box cars of 80,000 lbs. capacity from Haskell & Barker, and will build 10 cabooses at its Lafayette shops. The flat and box cars are for April, May and June delivery. The box cars will weigh 34,700 lbs., and will measure 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, inside measurements. The specifications for the flat and box cars are as follows:

Bolsters	Haskell & Barker
Brake-beams	Haskell & Barker
Brake-shoes	Haskell & Barker
Brakes	Westinghouse
Brasses	Haskell & Barker
Couplers	R. E. Janney
Door fastenings (for box cars).....	Haskell & Barker
Draft rigging	Haskell & Barker
Dust guards	Harrison
Journal boxes	Haskell & Barker
Roofs (for box cars).....	Haskell & Barker
Springs	Pittsburg Steel & Spring Co.
Trucks	Haskell & Barker
Wheels	Haskell & Barker

The specifications for the cabooses include:

Couplers	Monarch
Platform	Sessions

RAILROAD STRUCTURES.

ALBUQUERQUE, N. MEX.—The Atchison, Topeka & Santa Fe has plans ready for a large addition to the local machine shops. The proposed improvements are to cost several hundred thousand dollars.

BUFFALO, N. Y.—The International Traction Company has started work on a new car house 162 ft. x 525 ft.

CARRIZO, N. MEX.—The El Paso & Southwestern shops at this place were recently destroyed by fire, together with five engines; loss about \$190,000.

CONEMAUGH, PA.—The Council has granted permission to the Pennsylvania and work is shortly to be started on a large dam. The dam is being built for a reservoir to have a capacity of 4,000,000 gallons of water.

DULUTH, MINN.—The Great Northern expects to spend \$200,000 for a new freight house and terminals in Duluth.

LINCOLN, NEB.—Local reports state that the Chicago, Burlington & Quincy is planning to put up a new passenger station, to replace the one destroyed by fire last year.

MILWAUKEE, WIS.—The Grand Trunk has bought 24½ acres between the lake and the Kinnickinnic river as a site for terminals. In connection with the construction of the new terminals, the company is to add one or two modern car ferry steamers to its Milwaukee line.

NEW ORLEANS, LA.—Bids are wanted April 29, by Charles R. Kennedy, Comptroller, for building a viaduct over the tracks of the Southern Pacific on Newton street, Algiers.

Bids are being asked by the New Orleans Terminal Company for the proposed passenger station.

NEW YORK, N. Y.—A contract has been given to the F. W. Carlin Construction Co. at \$404,865 for changes at the Manhattan entrance of the Williamsburg bridge, to include an entrance to the proposed loop subway, over a steel viaduct with masonry approach. The other bids were Snare & Trieste Co., \$418,400, and Williams Engineering & Contracting Co., \$549,000.

PORT ARTHUR, ONT.—The Canadian Pacific is to improve its yard facilities; a new station and freight sheds are also to be put up.

WINNIPEG, MAN.—Extensive improvements are to be made to the Canadian Pacific shops here.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATCHISON, TOPEKA & SANTA FE.—This company has opened a new branch, built under the name of the Pecos & Northern Texas, from Amarillo, Tex., south to Plainview, 75 miles.

ASHEVILLE & HENDERSON.—Incorporated in North Carolina, with \$750,000 capital, to build a line from Asheville, N. C., to a point in Henderson County, 20 miles. C. F. White, of Skyland, is interested.

ATLANTA, STONE MOUNTAIN & LITHONIA.—Incorporated in Georgia, with \$50,000 capital, to build from Decatur, Ga., east to Stone Mountain, thence southeast to Lithonia with branches, a total of 30 miles. Such a line would parallel the Georgia Railroad. It is expected to start work at once on the proposed line. The incorporators include: A. O. Venable, J. S. McCurdy, R. M. Thompson, D. Shepard, A. B. Kellogg and G. R. Pace, of Decatur; T. C. Miller, B. H. Hill, S. H. Venable, J. L. Patrick, J. N. Ellis and C. D. Hill, of Atlanta.

CANADIAN NORTHERN.—This company has opened the section from Edmonton, Alb., to Stony Plain, 21 miles.

The Morinville branch from Edmonton, Alb., to Morinville, 23 miles, has been opened for business.

CHICAGO, CINCINNATI & LOUISVILLE.—This company has built about 12 miles of road, completing its entrance into Chicago, and the new line will be in full operation on April 7. The C., C. & L. has entered into a contract with the Wisconsin Central by which it secures a joint right to use the latter's freight terminal privileges at the Illinois Central terminal by a sub-lease. Both roads have the same president, and are almost entirely owned by the same financial interests. They have a common junction point at Chicago, and together form a through line from Duluth to Cincinnati.

CHICAGO, MILWAUKEE & ST. PAUL.—A contract is reported let by this company for building an extension from Mason City, Ia., south to Hampton, 30 miles. In connection with the Des Moines, Iowa Falls & Northern, which is building north from Iowa City, this will make the shortest line between St. Paul and Des Moines.

COLORADO, OKLAHOMA & GULF.—Incorporated in Oklahoma with \$3,000,000 to build a line from Arapahoe, Okla., southeast via Ardmore, Ind. T., to Sherman, Tex., 300 miles. J. M. Allen and J. Q. Robins, of Tupelo, Miss.; C. W. Young, of Memphis, Tenn.; W. M. Cox, of Baldwin, Miss.; J. S. Jenkins and W. E. Hodges, of Oklahoma City, are incorporators.

CORBIN & NASHVILLE.—This company, projected to build from Corbin, Ky., into Tennessee, is reported having let contract to Peter & Co., of Louisville, to build the first section from Tateville, south of Somerset, Ky., to Monticello, 25 miles. James Denton, Somerset, Ky., is interested.

DENVER, LARAMIE & NORTHWESTERN.—Plans are about ready and preliminary surveys have been made for building this proposed line

from Denver, Colo., via Boulder, Fort Collins, Laramie and Yellowstone Park to the northern boundary of Wyoming. (March 15, p. 383.)

DULUTH & IRON RANGE.—This company, it is reported, is planning to extend the Range spur from Mesaba, Minn., to Mayas Mine and thence to Syndicate Camp, about 12 miles.

FAIRCHILD & NORTHEASTERN.—This company has extended its road from Bright, Wis., north to Owen, five miles.

GRAND TRUNK.—The Provincial Legislature has authorized the city of Montreal to spend an amount not to exceed \$2,000,000 for a share of the cost of elevating the Grand Trunk tracks at that place.

ILLINOIS CENTRAL.—Contract has been given to H. C. Hodges & Co., of Birmingham, Ala., to build the Memphis & State, which is to be a double-track line from Aulon, Tenn., to the Nonconnah yard, about seven miles.

MEMPHIS & STATE.—See Illinois Central.

MEMPHIS, COVINGTON & NORTHERN.—Surveys are reported made by this company for building a line from Memphis, Tenn., northeast to Covington, 29 miles. Contract will be let as soon as financial arrangements are made. Such a line would parallel the Illinois Central. The W. K. Palmer Co., Dwight Building, Kansas City, Mo., is the Engineer.

MISSISSIPPI SOUTHERN.—Incorporated in Mississippi, to build from Gulfport, Miss., via Laurel to West Point, 225 miles. The incorporators include: Mayor T. H. Oden and M. Muhle, both of Laurel.

MISSOURI PACIFIC.—According to reports from Herrin, Ill., the St. Louis, Iron Mountain & Southern has completed an extension from Herrin to Marion, and will build a branch east 10 miles to the new coal town of Pittsburg.

NORFOLK & SOUTHERN.—The Columbia branch of this road has been opened for business from Mackie's Ferry, N. C., east to Creswell, 13 miles.

The Raleigh division has been opened for business from Raleigh, N. C., east to Zebulon, 24 miles.

OREGON RAILROAD & NAVIGATION Co.—Work, it is said, has been stopped on the extension of this road from Elgin, Ore., east to Wallowa, thence southeast to Joseph. Finished to the Wallowa river.

PENNSYLVANIA.—Reports from Newark, N. J., say that the Pennsylvania is about to take title to the property of the Crucible Steel Co. of America, in Harrison, which is the site selected for the new terminal yards of the electric line to New York. The property includes several hundred acres between the present tracks of the Pennsylvania and the Passaic river. Its acquisition will give free access to the main tracks and cut off half a mile of passenger trackage between Newark and New York. It is also reported that the plant of the Marine Engine & Machine Co., occupying one and a half city blocks just south of the Center street bridge in Harrison, will be taken over by the railroad for freight yard purposes.

PITTSBURG & LAKE ERIE.—Joint franchise rights, which involve the expenditure of over \$1,000,000, and which are intended to settle the warfare between the Vanderbilt and Gould interests in Pittsburg, have been approved by a special committee of select council after months of deliberation. The committee has approved an ordinance which permits the Pittsburg & Lake Erie to build a bridge over Main street and to construct nine tracks into its present terminal for passenger trains, with freight lines to the warehouses above Smithfield street. The Wabash company has made a traffic arrangement with the Pittsburg & Lake Erie to use the latter company's tracks to the warehouses, and has abandoned the project to erect an elevated spur along Carson street, for which a franchise was secured from the city councils over four years ago. If the city gives its permission to build the bridge over Main street in the West End, the two companies will use the same freight yards in the West End between Main street and Saw Mill run. The Pittsburg & Lake Erie will reach the yards by its present route, while the Wabash trains will run over the West Side belt line. The bridge over Main street is to be 125 ft. wide.

ST. LOUIS & OKLAHOMA SOUTHERN.—Contracts are reported let for building this proposed line from Monett, Mo., southwest via Pineville, Mo., and Tahlequah, Ind. T., to Muskogee, about 115 miles. Surveys are being made. Capital has been secured. J. A. Sturges, President, Pineville, Mo.; C. D. Bennett, St. Louis, Mo., Chief Engineer. (March 15, p. 391.)

ST. LOUIS & SAN FRANCISCO.—Announcement is made that this company will spend \$450,000 this year in laying new and heavier tracks and improving the roadbed of the central division between Springfield, Mo., and Fort Smith, Ark.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—See Missouri Pacific.

ST. LOUIS, ROCKY MOUNTAIN & PACIFIC.—This company has filed plans showing a proposed extension from Cimarron, N. Mex., the present western terminus, to San Fernando de Taos, by way of Taos Pass over the Sangre de Cristo mountains, 38 miles. The line is to be built this summer.

ST. LOUIS, SPRINGFIELD & OKLAHOMA WESTERN.—Contracts, it is said, are to be let about May 1 for building this proposed line from Lawton, Okla., east to Sallisaw, 225 miles. G. S. Stocker, of Stiegler, Ind. T., is President, and A. D. Goodnough, of Sulphur, General Manager.

SOUTHERN.—The company is to make extensive improvements on the Harriman-Nashville line. A number of new stations will be built, also side tracks, filling trestles, and new bridges. Some of the wooden bridges are to be replaced with iron and steel structures. The most expensive work is the filling of trestles.

TEXAS RAILROAD.—Incorporated in Texas, with office at Winnsboro, to build a line from Winnsboro north to Mount Vernon, 16½ miles. C. H. Morris, M. D. Carlock and J. M. Langford are interested.

TOLEDO, ST. LOUIS & NEW ORLEANS.—A meeting of this company was to be held in Carmi, Ill., April 2, to arrange for the construction of this proposed line, projected from Effingham, Ill., south to Brookport, 140 miles, with an east branch to Evansville, Ind., 65 miles, and a west branch to Ziegler, 22 miles. N. M. Burns, St. Louis, Mo., is President.

TOLEDO, WABASH & ST. LOUIS (ELECTRIC).—Incorporated in Maine with \$6,000,000 capital to build an electric line from Toledo Ohio, to St. Louis. The first 50 miles, from Toledo to Defiance, has been financed. C. W. Whitney is President; Geo. G. Metzger, Vice-President, and J. P. McAfee, Treasurer, all of Toledo, Ohio. F. M. Thompson, L. H. Stevens, C. C. Ballard, F. J. C. Little and I. E. Kearney, of Augusta, Me., are interested.

TOPEKA-SOUTHWESTERN.—Contract let to the Southwestern Railway & Construction Co., of Topeka, Kan., for building this proposed line from Topeka, southwest to Council Grove, 60 miles. Additional contract shortly to be let for bridges, buildings, etc. The line is to be laid with 80-lb. rails, and is expected to be finished by the first of next year. W. L. Taylor, President, Topeka, Kan.

VIRGINIA NORTHERN.—Incorporated in West Virginia, with \$50,000 capital, to build from Bradshaw, W. Va., south along Middle Fork in Virginia. T. E. Young, A. D. Baldwin, A. C. Hezlop and A. S. Heckler, incorporators, with office in the Rockefeller Building, Cleveland, Ohio.

WABASH.—See Pittsburg & Lake Erie.

WEST SHORE TRACTION.—A certificate of necessity and convenience has been granted this company by the New York State Railroad Commission to build a high-speed electric line from Tompkins Cove on the west bank of the Hudson river, New York, south to Carteret in Rockland County, about 25 miles. The company hopes eventually to extend the line south to a connection with the tunnels under the Hudson river, at or near Jersey City, and so to New York City. (March 15, p. 394.)

WILLIAMSBURG & IOWA CITY (ELECTRIC).—Organized in Iowa to build an electric line from Williamsburg, Ia., to Iowa City; also one from Williamsburg west to Des Moines. C. F. Burns, A. Cox, F. O. Harrington and D. S. Maher are interested.

RAILROAD CORPORATION NEWS.

ATCHISON, TOPEKA & SANTA FE.—On April 3 a semi-annual dividend of 3 per cent. was declared on the common stock, raising the annual dividend rate from 5 to 6 per cent. The first dividend of 3½ per cent. on the common stock was in 1901. In each year since then up to 1906, 4 per cent. was paid. The total payments in 1906 were 4½ per cent.

BELVIDERE DELAWARE.—An annual dividend of 10 per cent. has been declared on the \$1,253,000 outstanding capital stock of this road, which is leased to the Pennsylvania. The road runs from Trenton, N. J., to Manunka Chunk, 67 miles, with a 14-mile branch. Since 1897 the annual rate has been 5 per cent.

CANADIAN NORTHERN QUEBEC.—This company has given notice that it will exchange, not later than April 14, 1907, 4 per cent. perpetual debenture stock for Great Northern of Canada 4 per cent. guaranteed bonds, at the rate of £95 in stock for each \$500 in bonds. The Canadian Northern Quebec is a merger of the Great Northern of Canada, the Chateaugay & Northern and the Quebec, New Brunswick & Nova Scotia. (Oct. 26, 1906, p. 115.)

CANADIAN PACIFIC.—According to a press despatch from Ottawa, the Canadian Pacific has made a traffic agreement with the Oregon Railroad & Navigation Co. by which the Canadian Pacific se-

cures trackage rights over that company's line from Spokane, Wash., to Portland, Ore., 433 miles. The Canadian Pacific already reaches Spokane over the Spokane International, which runs from a point in British Columbia, on the Canadian Pacific's Crows Nest Pass branch, southwest to Spokane.

CHICAGO CITY RAILWAY.—See Chicago Union Traction.

CHICAGO TERMINAL TRANSFER.—The date for the foreclosure sale of this property has been set for May 3. It is understood that the Baltimore & Ohio will bid against the Hill interests for the property. (Mar. 1, p. 290.)

CHICAGO UNION TRACTION.—The city of Chicago approved by a popular vote on April 2 the traction ordinance. According to the terms of this ordinance, the Chicago Union Traction and the Chicago City Railway are to make needed improvements at a cost estimated at \$40,000,000. The city has the right to take over the properties for municipal operation at any time on six months' notice by paying the agreed present valuation of \$50,000,000 gross, plus the cost of rehabilitation. The companies are to receive 5 per cent. on their investment, after paying operating expenses, taxes, repairs, renewals and depreciation, and of the remaining surplus 55 per cent. goes to the city and 45 per cent to the company. The city reserves the right to authorize another company to take over the property on certain specified conditions. A board of three supervising engineers is to be created to approve all contracts and with the power to fix salaries. (Dec. 28, 1906, p. 574.)

ERIE.—It is understood that the \$3,000,000 notes maturing April 8 will be refunded by a much larger new issue, which, it is said, has been offered to Boston bankers.

GALVESTON, HARRISBURG & SAN ANTONIO.—See Southern Pacific.

GEORGIA RAILWAY & ELECTRIC.—The shareholders have voted to increase the common stock from \$6,014,600 to \$8,500,000. The majority of the new issue, it is understood, is to be distributed as a 3¾ per cent. stock dividend to the present stockholders. The company operates 144 miles of street railway in and near Atlanta, Ga.

GREAT NORTHERN.—The Supreme Court of Minnesota has handed down a decision holding that the Great Northern may issue \$60,000,000 additional stock without first getting permission from the Minnesota Warehouse Commission. This stock was to have been offered to stockholders last December, but an injunction was granted to the state of Minnesota restraining the issue. (Dec. 14, 1906, p. 168.)

KANSAS CITY SOUTHERN.—An initial dividend of 4 per cent. was on April 3 declared on the \$21,000,000 preferred stock. This calls for payment of \$840,000, as against estimated net earnings of \$1,965,000 for the year.

MT. MANSFIELD (ELECTRIC).—Charles E. Burke, of Stowe, Vt., has been appointed receiver. The road runs from Waterbury, Vt., to Stowe, 10 miles, and has outstanding \$300,000 stock and \$200,000 bonds. The American Trust Co., Boston, is bringing foreclosure proceedings.

OREGON RAILROAD & NAVIGATION.—See Canadian Pacific.

PENNSYLVANIA.—See Belvidere Delaware.

SOUTHERN PACIFIC.—Holders of a large amount of the \$6,354,000 Western division second mortgage bonds of the Galveston, Harrisburg & San Antonio have brought suit to enjoin the Southern Pacific from paying dividends on its common stock. The plaintiffs assert that the Union Pacific controls a competing line, and ask that the Union Pacific and its officers be restrained from voting on any stock of the Southern Pacific or exercising any control over the Southern Pacific or its subsidiaries, including the Galveston, Harrisburg & San Antonio. No interest has been paid on the second mortgage bonds, referred to above, for many years. In 1891 an agreement was made releasing the Southern Pacific from its obligation to pay this interest, and making the securities income bonds. The plaintiffs claim that the Galveston, Harrisburg & San Antonio is an integral part of the Southern Pacific system, and is only showing a deficit because of the methods of accounting adopted by the management. The Southern Pacific interests contend that the Galveston, Harrisburg & San Antonio has not earned the interest on its bonds, and that its earnings do not contribute to the Southern Pacific dividends, but that, on the contrary, the Southern Pacific has advanced money to the Galveston, Harrisburg & San Antonio for payment of first mortgage interest and for improvements.

TOLEDO & WESTERN (ELECTRIC).—Control of this road, which has been in the hands of a receiver since July 2, has been acquired by the Toledo Railway & Light interests. (Jan. 25, p. 130.)

TOLEDO RAILWAY & LIGHT.—See Toledo & Western.